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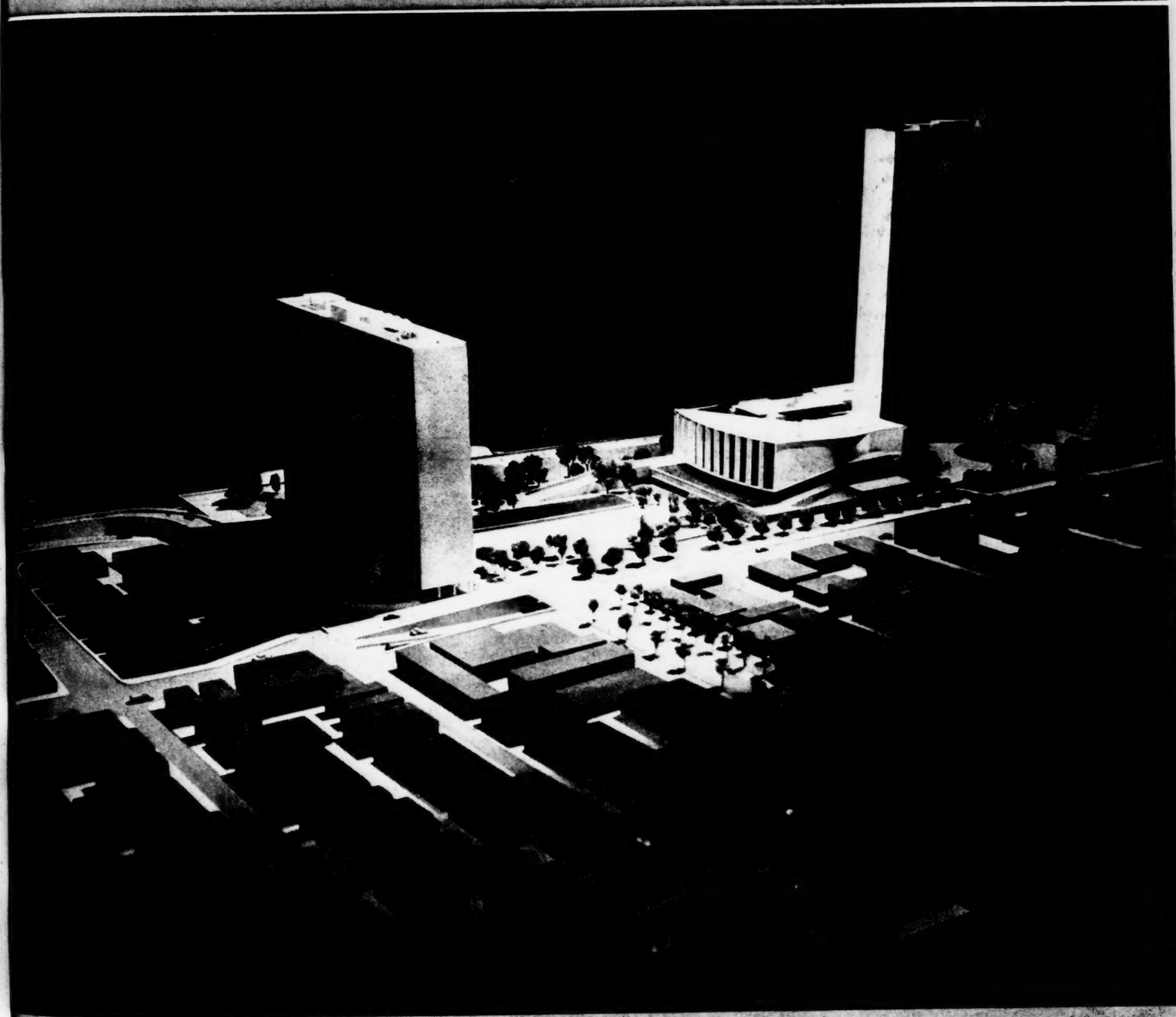
HEATING AND VENTILATING

AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION



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Flanged Joints for Piping . . . page 77

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THIS MONTH'S COVER

New scale model of the proposed permanent headquarters of the United Nations. Designed by the Board of Design Consultants of the United Nations Headquarters Planning Office, the model is subject to approval by the General Assembly. Official United Nations Photo.

From the cradle

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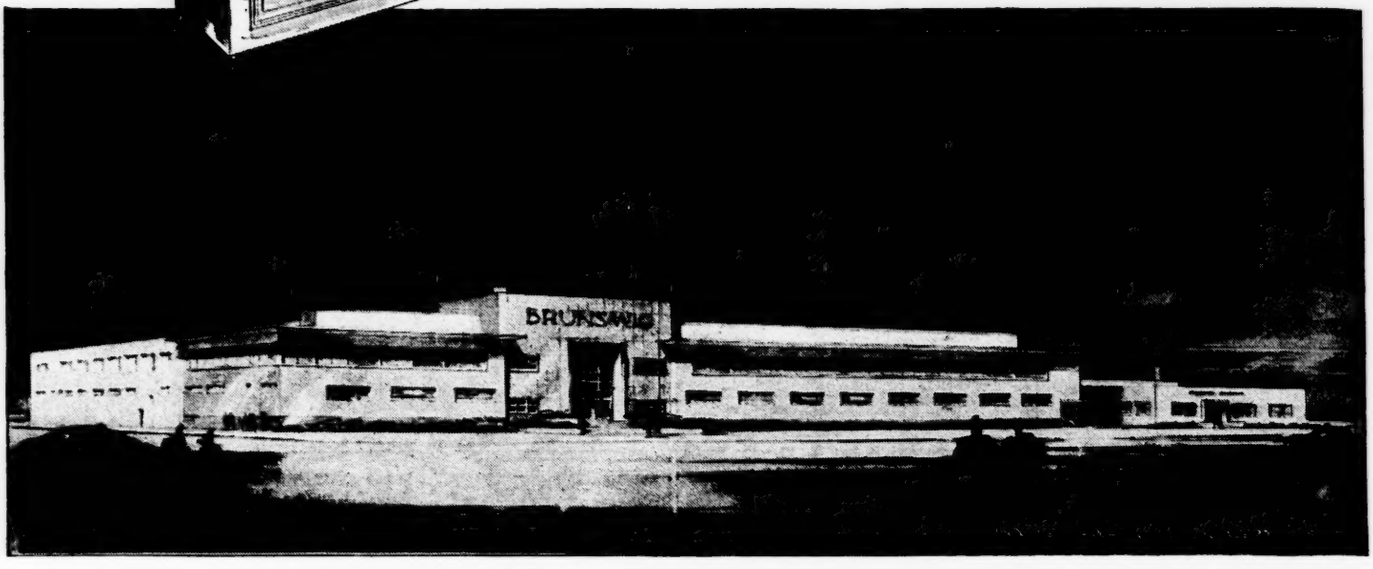

General Office and Warehouse Building, Brunswig Drug Co., Vernon, Calif.
Architects—Albert C. Martin and Associates, Los Angeles. Mechanical Engineer—Lester R. Kelly, Los Angeles. General Contractor—Wm. Simpson Construction Co., Los Angeles. Plumbing & Heating Contractor—Howe Bros., Los Angeles. Ventilating & Air Conditioning Contractor—W. S. Kilpatrick & Co., Los Angeles.

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Washington News

LORING F. OVERMAN

IN its September report on construction and construction materials, the Construction Division of the Department of Commerce carried a couple of graph illustrations intended merely to clarify certain phases of the building picture. In addition, however, it is not difficult to read into these graphs a fairly plausible explanation of what might be called this period of phoney prosperity.

Phoney? Well, that word may be a bit strong, but it will certainly be conceded that all is not exactly kosher when the following conditions, among others, continue to exist.

More than 60,000,000 are gainfully employed (largest work force total in U. S. history), yet industry's output for August fell 9 points below the peak it reached in March of this year (198% of 1935-39 average).

Actual weekly earnings of nonagricultural wage-workers average 60 percent above prewar, but the buying power of that income is up only 20.1 percent.

Europe will starve, we are told, unless the U. S. backs the $22 million Marshall plan—yet few Europeans appear inclined to help themselves, and powerfull forces seem to hope they won't.

American exports zoom until our Government stops handling out dollars for foreign buyers to make payments to U. S. producers.

New construction activity in this country is at the rate of $1.2 billion per year (only $400 million below the wartime peak in 1942), yet getting a house, store or factory completed is something involving miracles.

Steel production exceeds the fondest prewar dreams, yet no industry dependent upon steel gets adequate deliveries.

Even the heating and ventilating industries' output —as reported for July by the Construction Division's September report—falls considerably below the previous month, with only cast iron boilers, mechanical stokers and warm air furnaces registering gains.

Construction Activity

But back to those Department of Commerce graphs.

No. 1, entitled "New Construction Activity, 1942-1947", pictures Total Value of Construction as a line starting at $800 millions for the month of January, 1942; zooming to $1.5 billion in July of the same year; then declining to a low of $300 million in February of 1945. The line then climbs to the billion dollar mark again during August and September of 1946, and as of August, 1947, is pictured as zooming up above the $1.2 per month level. Sounds good!

But look at Chart No. 2, entitled "New Construction, 1942-1947, in Terms of 1939 Prices." Here the line representing Total Construction has the same ups and downs as in Chart No. 1, but a marked difference is noticeable. Even as early as January, 1942, the $800 million per month expenditure was delivering only $600 million worth of completed projects (at 1939 prices), and the 1942 peak month's expenditure of $1.5 bought only one billion dollars' worth of 1939 building deliveries. The payoff comes when the graph line reaches August of 1947, when $1.2 billion *spent* for construction buys only as much as $600 million would have purchased in 1939!

With construction projects being completed during the building season peak at a rate equivalent to 1939 completions of only $600 million per month it is small wonder that all the fuss and furor in the construction industry is making so small a dent in the backlog of needed homes, apartments, commercial buildings and industrial projects.

And therein, no doubt, lies the key to many of the problems existing in our country today. We work, think, and buy in terms of dollars. Production, however, retains its own units of measure—board feet, square feet, lineal feet, dozens, tons, carloads, man-hours!

Back to Price Control?

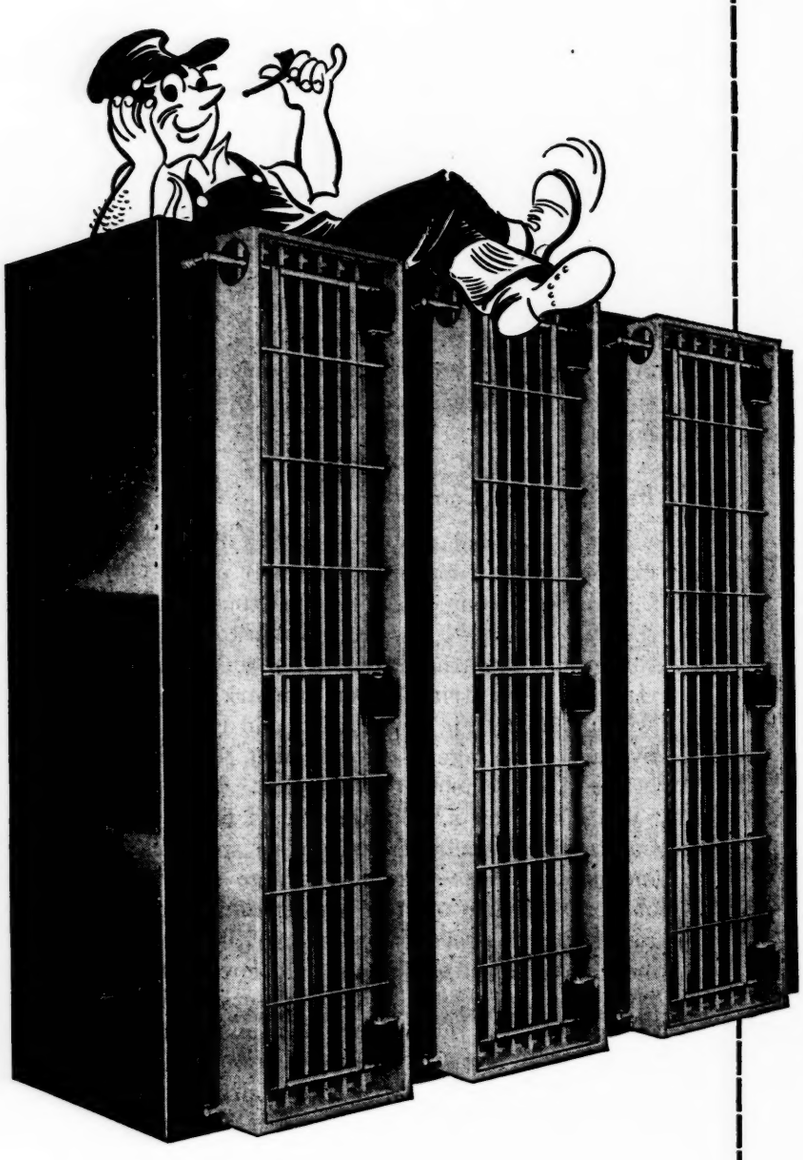
The out-of-balance relationship between these inflexible units of measure and their prices on the present market is one of the liveliest topics in Washington today. "We'll just have to go back to price control and rationing," was the first reaction in some government circles. This trial-balloon remark, which received wide publicity via newspapers and radio, was greeted by such a barrage of protest that the proposal is not being given serious consideration.

Rationing on a voluntary basis is the current formula, with President Truman as sponsor. Idea is to induce buyers to take it easy, go slow, reduce purchases and take off the big-demand pressure that is forcing prices ever upward. While admitting that only a reduction of demand will lower the price level, hope for the success of the voluntary rationing idea is not too high. Experience has indicated that buyers' strikes and similar price-resisting moves are short-lived. Folks will resist the raised price tag for awhile; then become used to it and accept it as a new normal level.

CIO has come out publicly for the return of Government price control—but has made no mention of wage control. Quite naturally, it would like to take up what it sees as the slack between the wage-earner's buying power and his actual wage; then call a halt. Considered more likely is a third round of wage increases, another round of price increases, and then —who knows?

There are many who think that only an old-fashioned postwar recession will correct the present unbalance between prices and values. No one really wants such a solution, yet all fear it, and many predict that another round of "pricing things out of the market" will signal the reverse spiral. Similar predictions to date have failed to materialize, fortunately,

Maintenance men get a break



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but the current situation involves conditions worthy of close watching. Employers in the H & V field may find food for thought in the suggestion that "cost of living bonuses" be studied. Bonuses may be withdrawn when conditions inspiring them change; a wage rate, formally raised, is difficult to contract.

Steel

Meanwhile, very real shortages exist, particularly among those industries dependent upon steel production, and even Congressional investigating committees are having great difficulty in putting a finger on the source of the trouble. At a recent hearing before a Senate Subcommittee on Small Business, the steel industry was accused of curtailing employment in the automobile industry and others, by refusing to authorize immediate expansion of steel production facilities.

Steel executives passed the buck to strikes in coal mines and on railroads; to lack of strap, and testified that the industry should be able to catch up with demand within the next two years with its present capacity and contemplated modest additions.

Steel company executives admit that the amount of steel currently being produced falls short of demand, although the American Iron and Steel Institute states that the gap between supply and demand would be much narrower than it now is if 12 million tons of finished steel products had not been lost last year in a series of major strikes. The recent railroad strike that shut down four Carnegie-Illinois Steel Corp. plants also caused a loss of about 180,000 tons of steel, thus cutting steel quotas of the corporation's customers.

Members of the Subcommittee were told that if the production rate achieved during the first half of the year is maintained, the 1947 output of steel ingot and castings will be 18 million tons higher than in any previous peacetime year. Steel industry spokesmen also reported that the industry's plans for an increase of 3 million tons of sheet and strip mill capacity have been delayed by the inability of machinery and equipment suppliers to make deliveries on schedule.

Any further large scale expansion of the steel industry, they contended, would divert steel from immediate consumer use and further aggravate scarcities. Anyway, they say, since the industry believes it can catch up in two years, what would become of the added capacity when conditions return to normal?

World Crisis

The Subcommittee also heard pleas that the present period of shortage is sufficiently serious to be regarded as a world crisis justifying either government construction of additional steel facilities, or a return to an allocation system for steel products. Thus is raised again the question of whether, and how far, government should go in supplementing or directing the affairs of private industry. The committee's recommendation is being readied for the next session of Congress.

Another Subcommittee which will present to Congress a report that will be of interest to H & V readers is the joint Senate-House group studying the housing problem. Hearings at Washington in September unearthed numerous clues to present difficulties in this field. Of the 1,500,000 new home units needed annually to provide a minimum of decent housing, the market will now take only about 820,000 because prices are so high that only this number can be sold.

As an example of reasons for some shortages, committee members were told that nails are short mainly because they are a low-profit item, with the result that the steel industry is simply not producing them. Senator Joseph McCarthy (R. Wis.) proposed calling in the steel chiefs, explaining the need for nails and other short items, and pointing out that unless the industry produced them voluntarily, Congress might have to set up some system of allocation by legislation.

Under these conditions, the steel industry experts are quoted as admitting, the industry might get out enough nails for America's building program.

The housing subcommittee was also told of the slowdown effects of antiquated building codes, with some witnesses estimating that the adoption of more modern codes would cut building costs immediately by 5 to 10%.

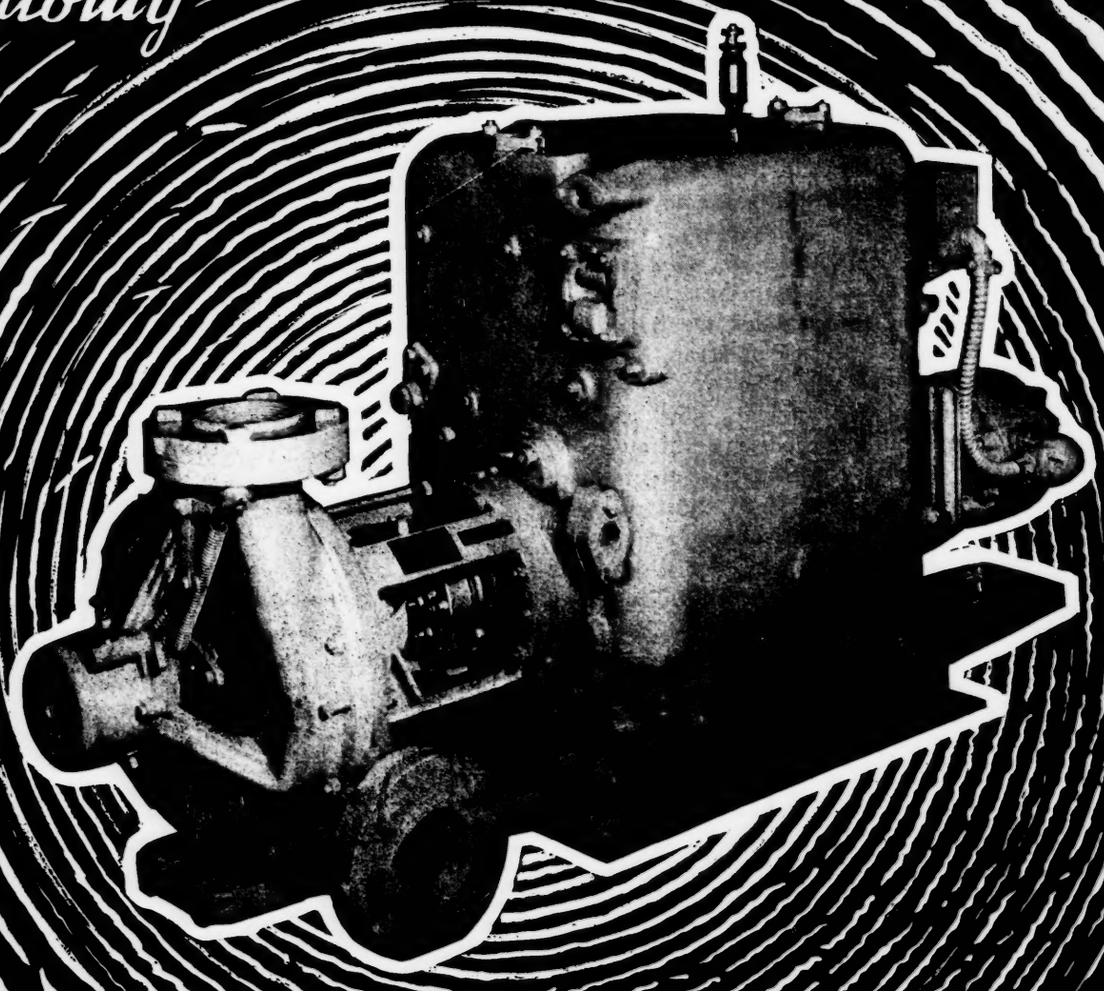
Labor Force

The Congressional investigators were also told of restrictive building practices; of the inadequacy of the present labor force of only 1,700,000 and of the need for more than the 100,000 apprentices now in training. Also discussed were financing methods, trade practices, and the possible need for federal aid in slum clearance projects. It was obvious that members of the committee realized the magnitude of their assigned task of recommending a method of coordinating more effectively the work of the sprawling building industry. It was apparent, too, that they regarded many of the industry's traditional practices as roadblocks to the present goal of more housing, and quickly. If the tone of the Washington hearings is maintained at others from coast to coast, the committee may come up with some drastic suggestions. Whether or not Congress will concur is, of course, another matter.

Of possible interest to those who plan H & V installations is the fact that steel joist construction has recently been given official approval as a light-weight floor construction by the American Standards Association.

The standard was developed by an American Standards Association committee sponsored by the American Iron and Steel Institute and the American Society of Civil Engineers. It is intended for use by municipal and state building officials as a means of increasing uniformity in building code requirements. It should also be useful to architects and engineers because it is a complete specification on steel joist construction. The steel joists act as a support for the metal lath form, which is used as reinforcement for the top concrete slab, and ceiling lath may be applied directly to their bottom chords, thus eliminating the necessity for furring channels.

Centralized Heating Economy



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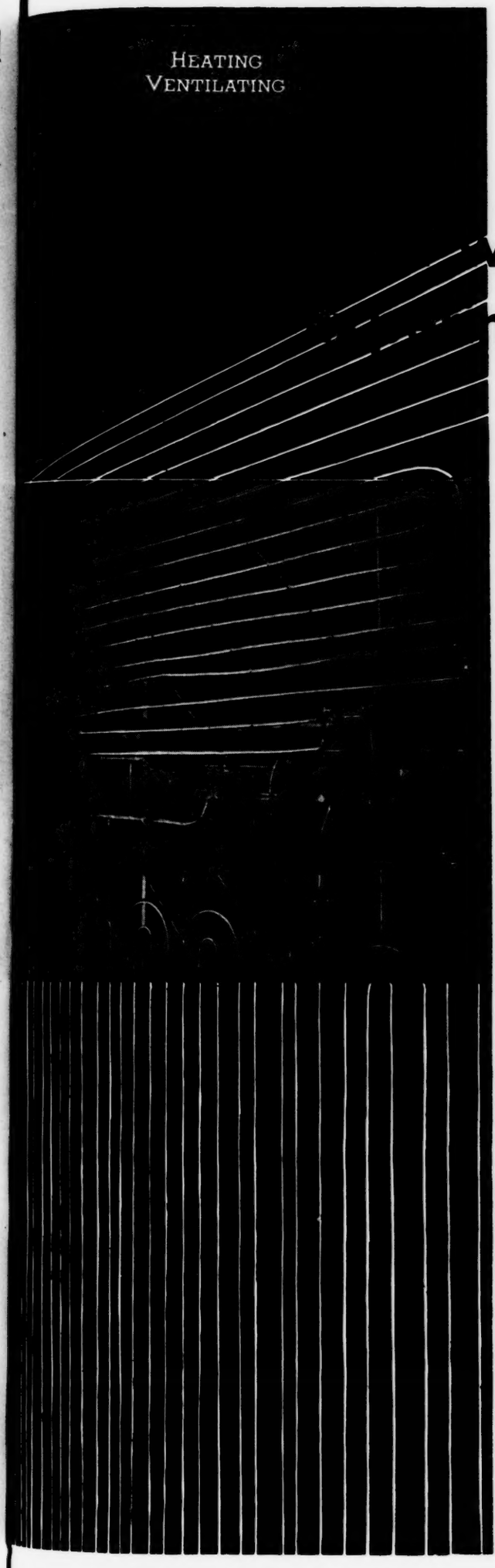


vith Copper Tubing—
ment in Practice

D. L. MILLS and L. J. LATART
Research Department, Revere Copper and Brass Incorporated
New York, N. Y.

This is the first of a series of articles describing an experiment in panel heating which will bridge the gap between the highly technical research laboratory and the practical man in the field. A new building to be used by Revere Copper and Brass, Incorporated, as a laboratory is being equipped with several types of copper tubing radiant heating panels. Practical installation pointers in this and three subsequent articles will be followed by a report of observed results of a planned heating program.

WITHIN the last few years a great deal of research has been conducted on the subject of panel heating. However, most of this work, has dealt with the engineering design aspects. Very little in the way of controlled experimentation has been reported on the multitudinous practical problems of installation, operation, and maintenance that beset the heating contractor, the plastering or masonry contractor, the architect, and the operating engineer. Equations have been developed to permit calculation of the required panel area but dependable data on installation costs per unit area do not seem to be available at present. Heat transfer rates for complicated panel locations have been developed in all their mathematical exactness but no simple rule has been established for estimating the effect of placing lath above instead of below the heating coils or for changing the depth of bury of tubes embedded in a concrete floor slab.

In an effort to fill the gap between the highly technical research laboratory and the practical man in the field, the research department of Revere Copper and Brass Incorporated has undertaken a comprehensive program of test and experiment in a large occupied structure under conditions of normal comfort occupancy. The research staff, in cooperation with consultants, has set up a test program covering approximately 18 months which will lead to a series of technical papers and articles designed to answer accurately and impartially many of the vital practical questions that continually recur whenever panel systems are being installed or operated. All phases of the work are being conducted under exacting laboratory control conditions with accuracy a fundamental requirement. As data are obtained they will be analyzed

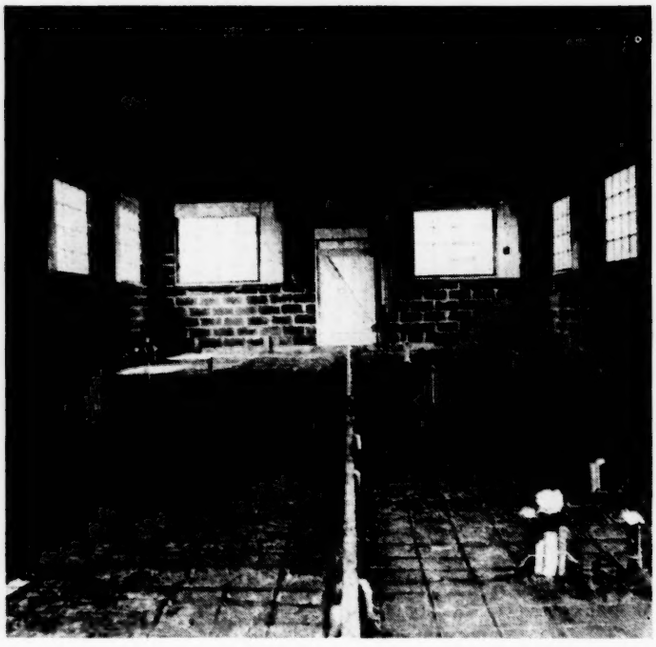


Fig. 1 ▲

Photos are by R. P. DESTITO of Revere's Research Department.

Fig. 3 ▲

Fig. 1. (Above, left) Interior view of building before pouring concrete or erecting partitions.

Fig. 2 ▼

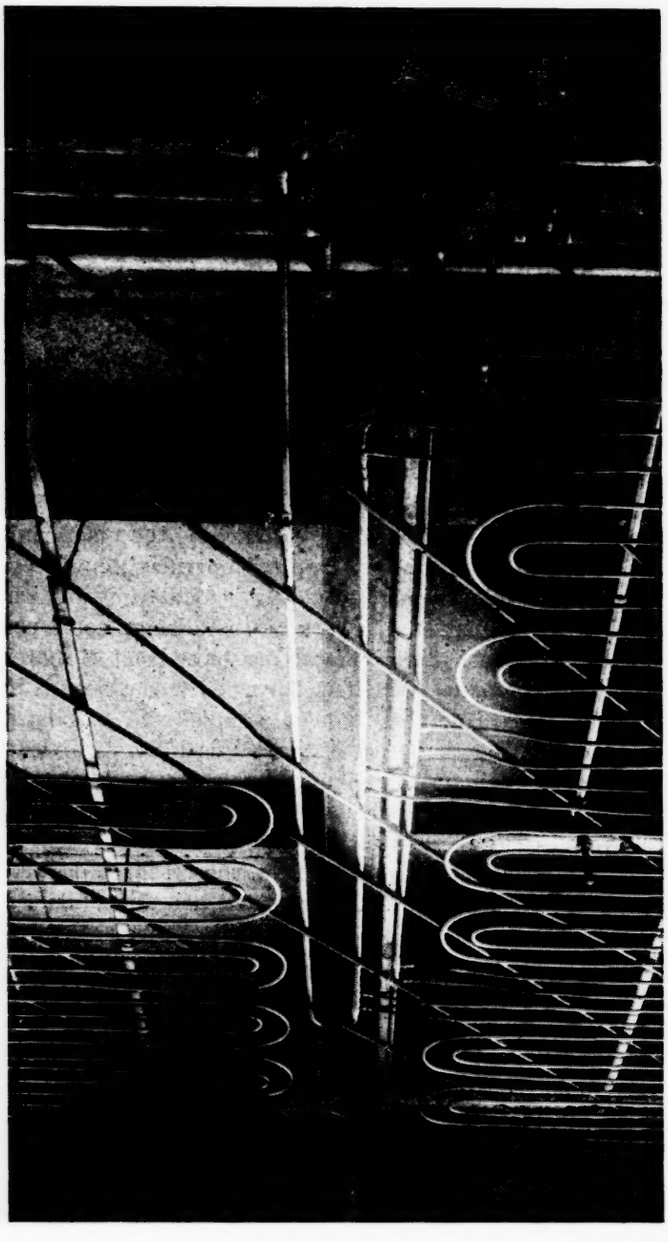


Fig. 2. (Below, left) Main supply and return lines are shown at top of illustration with typical branch headers. Note diagonal supporting channels, double coils, and reverse return flow principle.

Fig. 3. (Above) Method of forming coils on bench.

and the results together with records of original test sheets, made immediately available to the public through publication in the usual engineering and trade journals. Basically, therefore, the program is being undertaken with the hope that its results may be classified as a valuable public service.

The structure which is being used for test purposes is a new building 25 ft by 60 ft (Fig. 1) with an 11 ft 4 in. hung ceiling of plaster on metal lath. It is being erected to provide additional laboratory facilities for the metallurgical section of the research department of Revere in Rome, N. Y. The building is being constructed of cinder blocks with 4-in. tile exterior finish laid up with a ½-in. air space between the blocks and the tile. Plaster will be applied directly to the cinder blocks as an interior finish. There is no basement in the building and a concrete floor slab 4 in. thick is laid on gravel fill. The hung ceiling of this one-story building is approximately 18 in. below a flat roof consisting of 1 in. Celotex, ⅞ in. air space, 2 in. gypsum plank, 1 in. Celotex and built up roofing. This roof construction was designed to reduce heat losses to a minimum.

The hung ceiling is supported by 2 by 2 in. angles running across the building on 3 ft centers. Fixed to the underside of these angles are ¾-in. steel channels on 12-in. centers (Fig. 2) running diagonally across the building. This diagonal arrangement was used because some of the copper tube heating coils which are attached to the channel run lengthwise of the building, whereas other coils due to the requirements as dictated by partition arrangement run crosswise. The service heating system for the building is a ceiling

type panel system of forced circulation hot water using sinuous coils throughout made of ⅜-in. Type L soft temper copper tube on 4-in. centers. All coils are double as shown in Fig. 2. The average length of each tube-run between supply branch and return branch headers is 75 ft with 92 ft as a maximum length of single tube coil and 64 ft as a minimum.

Main supply and return lines are 1½-in. Type L hard temper copper tube and the flow system is designed on the reverse return principle (Fig. 2). Branch headers are ¾-in. and 1-in. Type L hard temper copper tube. The system is down fed with the mains running the length of the building slightly above the coils in the attic space above a central hallway.

Each coil is vented by a tee located in each return header (Fig. 5) just ahead of its connection to the return main. The tee branch faces up, and from it a ⅜ in. Type L copper tube rises approximately 12 in. with a 180° return bend at the top continuing downward to a petcock located in an access box flush with the hung ceiling of the hallway or other convenient place. This venting arrangement seemed preferable to automatic vents in this particular installation.

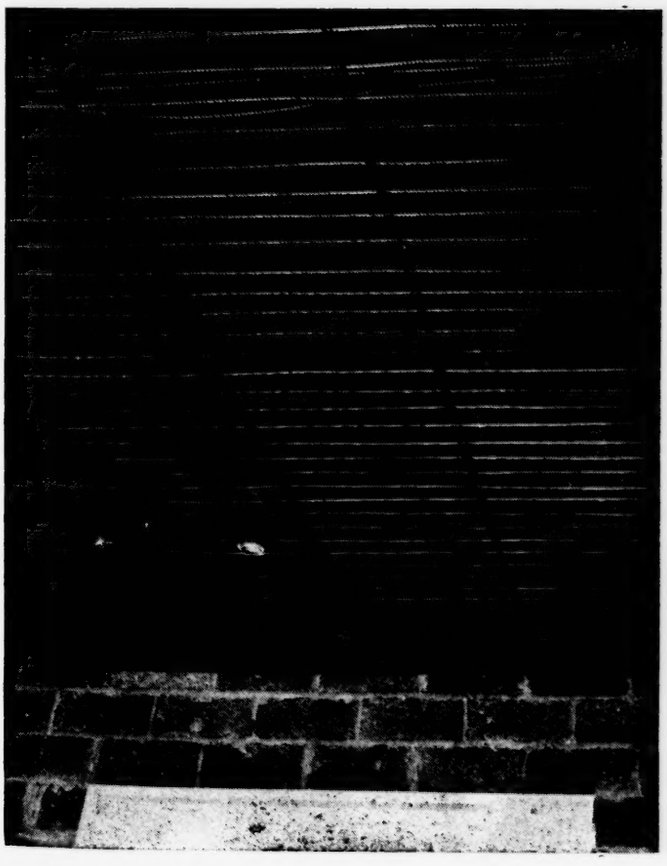
Balancing cocks are located in the return header of each coil so as to be accessible through the same boxes

Fig. 4. (Below) Completed lathing on ceiling, ready for plastering.

Fig. 5. (Above, right) Vents and adjusting cocks are shown circled. Access boxes not yet installed.

Fig. 6. (Below, right) Wiring metal lath to supporting channels.

Fig. 4 ▼



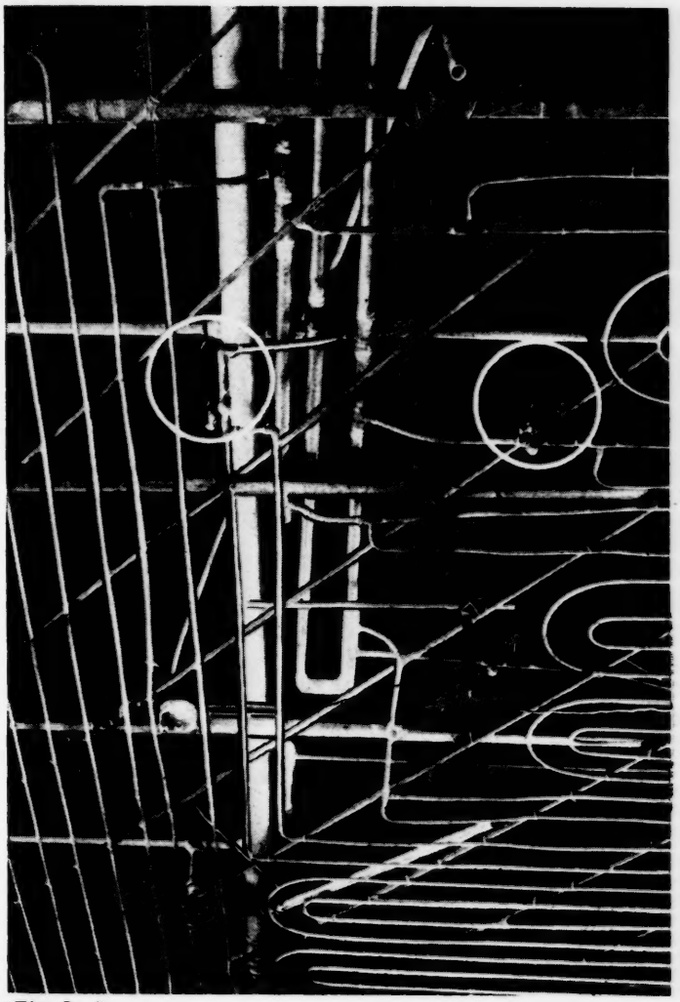


Fig. 5 ▲

Fig. 6 ▼

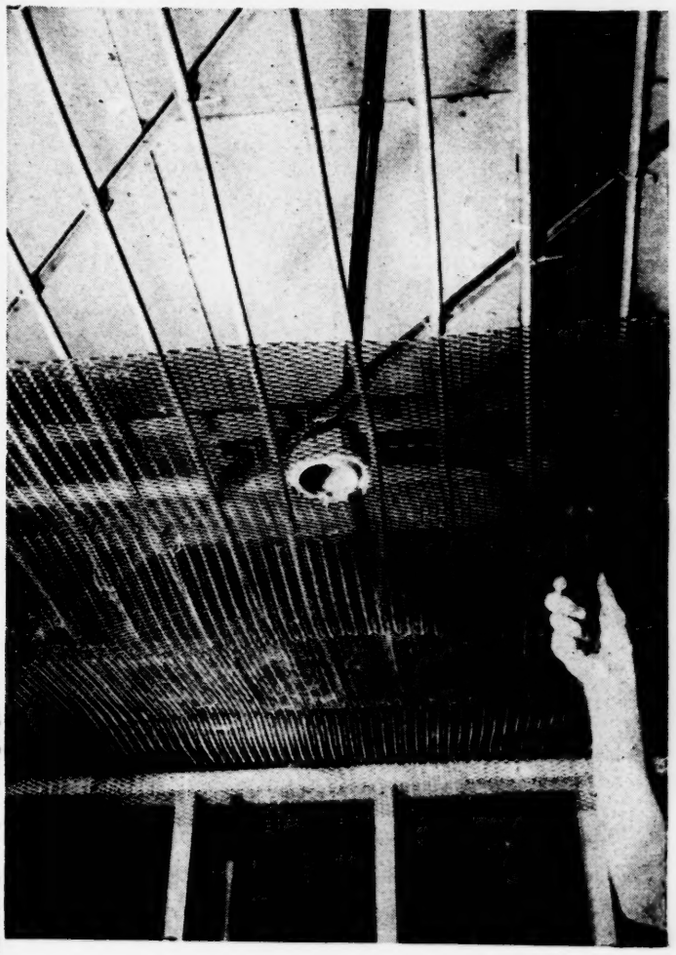
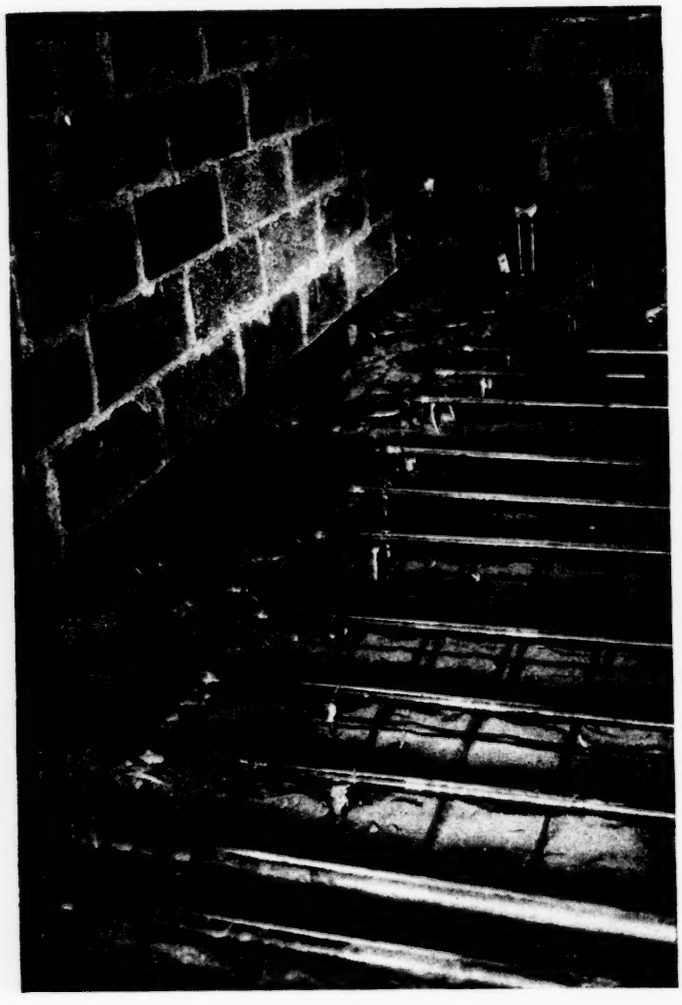


Fig. 7 ▲

Fig. 8 ▼



in the ceiling that are provided for the venting petcocks.

The ceiling system was designed to maintain optimum comfort with 120F panel surface temperature when outside air is at —10F and the ventilation rate, varying from room to room on account of the use of exhaust fans in some laboratory spaces, ranged from ½ to 2 air changes per hour. The design method used was a graphical adaptation* of the rational heat balance procedure.

A total of 3,600 ft of ⅜-in. copper tube was used for the ceiling coils with a total design flow rate of 15 gpm based on a temperature drop of water through the coils of 10F. The total head loss for the system is calculated at approximately 10 ft.

All ceiling coils were made by uncoiling the copper tube from standard 60-ft coils into wood strip guides attached to the top of a temporary bench erected inside the building. Return bends were made around wood forms (Fig. 3) properly spaced at each end of the bench. Where necessary, soldered coupling joints in the straight lengths of tube were made right on the bench.

After the coils were formed it was an easy matter to lift them into position on the ceiling by means of a simple wood jig and then wire them to supporting members. The metal lath was then applied on the underside of the coils ready for plastering (Fig. 6). This provides an even surface for plastering (Fig. 4) as though no tube were installed. A detailed account

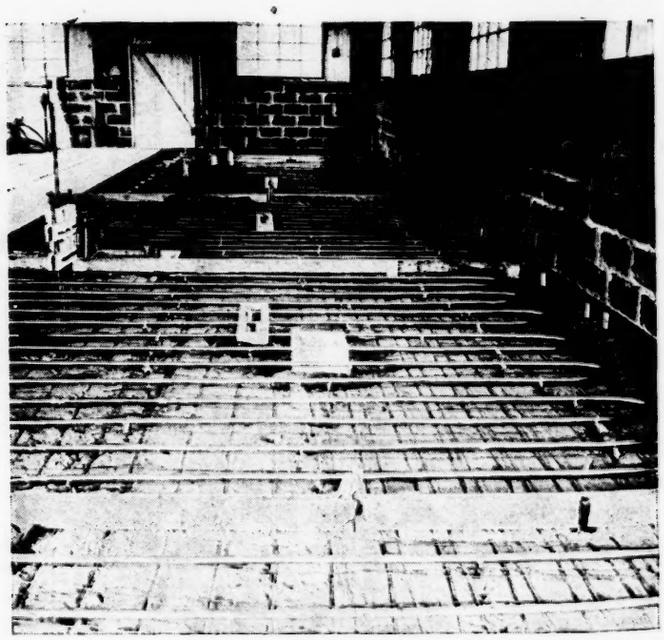
*A Graphical Design Procedure for Radiant Panel Heating. F. W. Hutchinson, Revere Copper and Brass Incorporated, 1945.

Fig. 7. (Above, left) Grid coils in position before pouring concrete.

Fig. 8. (Below, left) Supply end of grid coils showing thermometer well and main cut-off valve. Individual cut-off valves are in return headers.

Fig. 9. (Below) Sinuous coils in floor, ready for pouring concrete.

Fig. 9 ▼



of the easy method of forming the coils and the means of transferring them from the bench to the ceiling will be given in a later article.

Experience with the 3600 ft of ceiling coil showed that an average journeyman and helper, without previous experience on this type of installation, could be expected to bend, jig, raise, and wire into place approximately 700 to 900 ft of copper tube per 8-hour day with all couplings bench soldered as part of the operations.

In addition to the service heating system, 1750 ft of ¾-in. copper tube were installed in floor coils solely for experimental purposes. Five sinuous type floor coils (Fig. 9) each approximately 11 ft by 11 ft were installed at four different embedment depths in one half of the concrete floor. These depths are ½ in., 1 in., 1½ in. and 2 in. below the finished floor.

Since the coils are in every other respect identical it is expected that test results will provide reliable data as to the influence of depth of bury on energy dissipation rates and effectiveness of control. All floor coils have a uniform tube spacing of 9 in. on centers and the floor systems are so arranged as to permit operation entirely independent of the ceiling system.

The other half of the floor, which is divided longitudinally, is experimentally heated by means of grid type coils (Fig. 7) using ¾-in. Type K hard temper tube in 57-ft straight lengths. Four grid coils separately valved (Fig. 8) are embedded at four different depths below the finished surfaces of the concrete floor similar to the sinuous coils. Tests on these floor sections are expected to provide data on the effect of the difference between the coefficients of thermal expansion of the tube and the concrete and also to assist in checking analytically transient effects associated with intermittent versus continuous operation of the circulator.

All floor panels are arranged to permit accurate metering of flow rates and to allow determination of the temperature of water to and from the coils. This will be done by means of flow meters and thermocouples with mercury thermometers for check purposes. Thus the rate of energy dissipation from the coil on the panel surface and also in the opposite direction can be determined with precision. Thermocouples are likewise located at ¼-in. intervals under the coils to permit determination of the temperature gradient from coil to ground with consequent evaluation of the rate of energy loss from the rear of the panel. Ground losses are being further checked through use of a thermocouple grid located directly under the center of each floor coil and extending into the ground a depth of 5 ft.

Thermocouple grids are located in respective sections of the system to permit determination of both the horizontal and vertical temperature gradients so that data on tube spacing and varying depths of bury can be both checked and extended.

In order to restrict the heat flow between adjoining floor slab sections and between the floor slabs and outside walls, strips of 1-in. Celotex were inserted around all edges of each portion of the floor slab in which the experimental coils are located.

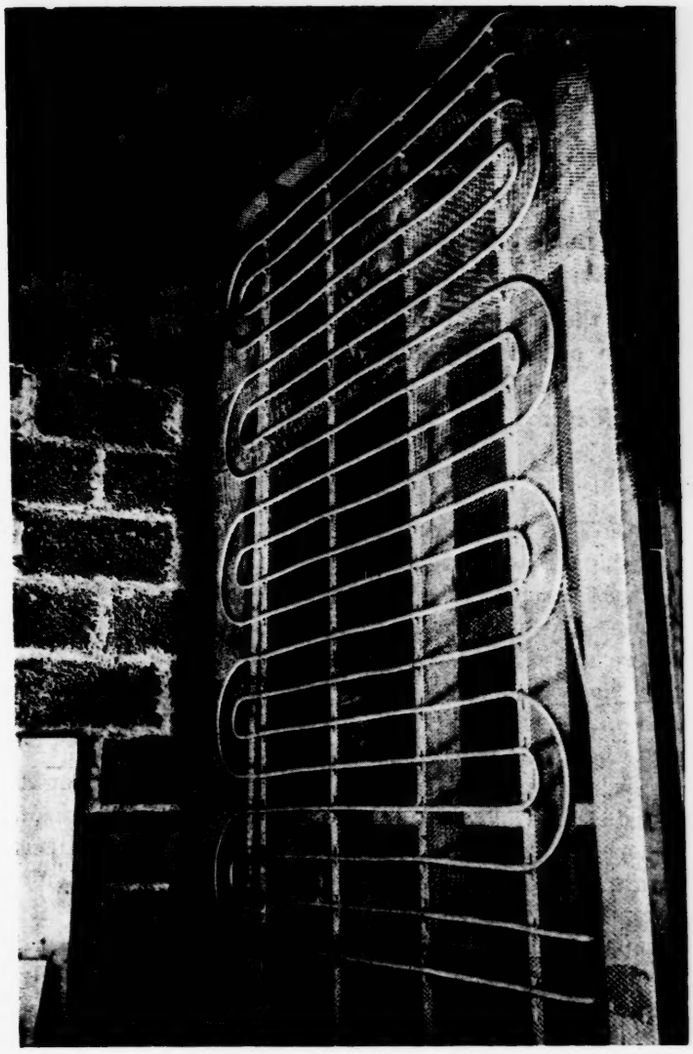


Fig. 10. One wall coil installed in front of metal lath. Ceiling coil behind lath.

After the pouring of the entire floor was completed, the concrete contractor stated that no more time was required in pouring over the coils than for an ordinary floor slab without coils.

One wall panel is being installed in a narrow room with excessive exposure, and unlike all other coils of the installation the copper tube in this wall panel (Fig. 10) is fixed on the room side of the expanded metal lath. During the plastering operation it is expected that interesting data will be obtained as to the relative difficulty and time required to plaster a coil fixed below rather than above the lath.

Publications from this experimental program are expected to take two forms. The first group will consist of a series of practical articles dealing with installation and operating experience relative to the influence of different methods of coil fabrication, different methods of applying plaster and related matters on first cost. A second series will be concerned with the more technical problems which pertain to the engineering aspects of panel heating. Papers from the second series will not be ready for release until after the start of the next heating season, but other articles of the first series are now in preparation and a consideration to be covered in next month's issue will be techniques of copper tube fabrication.

Blowoff Tanks and Systems

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Since there is no complete standard to follow in the design of blowoff tanks, data on a few such tanks and systems should prove of value. The good and bad features are given of the designs described.

HOW to install a blowoff tank and its connecting piping so that the blowdown will not endanger persons or damage property has long been a problem. Tank explosions occur from time to time, many fatal. There are records of injuries from such accidents as well as considerable property damage due to laxity and mistaken design economy. To do the job right costs but little more.

Each design then should be made with the thought (1) that the blowoff tank is there for the purpose of absorbing the impact of mingled hot water and flash steam as blown down from the boiler (2) to provide some space for the liberation of flash steam and its escape as formed when pressure drops and (3) to store or cool water until its temperature is sufficiently lowered.

Unfortunately, there is no complete design standard or common knowledge of the subject. No doubt for some time to come, there will be another and another design, for each application seems to vary and to ignore some good points brought out by other designs. However, there has been some standardization in more recent years due to laws of various states and municipalities. In addition, requirements of insurance companies focused attention to certain phases of the problem. Such laws and regulations agree, however, only in the main. Some insurance companies are rather limited in their requirements, leaving the balance to recommendations. There is a great deal of misunderstanding on what is best as can be seen by glancing over the illustrations selected from various applications as encountered by the writer.

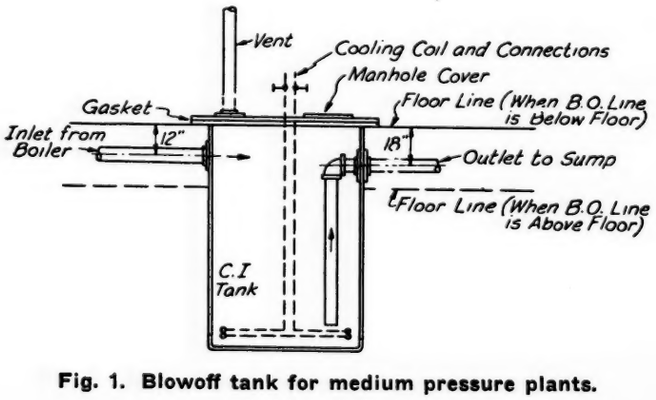

Fig. 1. Blowoff tank for medium pressure plants.

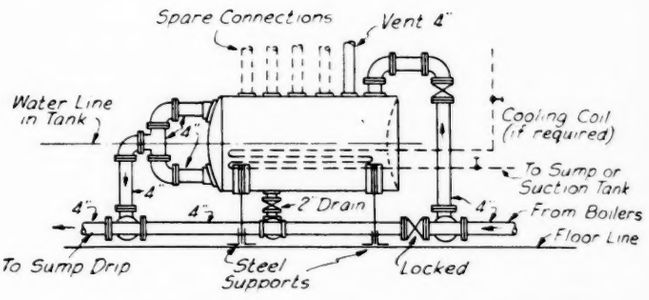

Fig. 2. Blowoff tank with short radius pipe fittings.

Why a Blowoff Tank is Required

The discharge of blowoff water or hot water directly into municipal sewers is prohibited by many plumbing codes. These codes stipulate that some form of condensing tank or cooling coil be used and that the discharge be either to the sewer outside of the building and house trap, or over a publicly placed, effectively trapped and vented sink supplied with water. Any water over 130F is apt to be offensive in odor; alternate expansion and contraction is apt to cause leakage of underground lead calked joints. Where tile sewers are used, they are liable to be cracked, while the pressure within the plumbing system may force the seals of traps on plumbing fixtures. This would permit entrance of sewer gas into the building.

Size of Tank Required

One of the most frequent questions concerns the basis for fixing the proper size of the tank. There is, however, no real rule on the matter though there are certain offhand rules which take no account of varying conditions. Some provide for the storage of water equal to the blowdown of 2 in. on the boiler gauge glass. Others make the capacity equal to 4 or 5% of the water capacity of the number of boilers to be blowndown simultaneously. This is usually only one unit.

Actually, the amount of blowdown has no fixed relation to the volume of water in a boiler. It all depends primarily on conditions within the plant as to boiler pressure and load, frequency and duration of blowdown, and the foaming and scale characteristics of the water. Even the type of boiler enters into the problem. A fire tube boiler, for example, may contain four times as much water as a water tube boiler of the same horsepower. This would affect the size of tank unless the blowdown is made more frequent and of shorter duration.

The deeper a tank, then the less steam that is apt to be blown into the sewer. Furthermore, there should be a sufficient flash steam liberating area or a momentary steam storage space above a water line which is far from stable. This space is often taken as 15% of the water storage space, or again as a space which in height is as much as 30 in. above the water level. Usually this height is only 18 in., just enough to allow for the free escape of flash steam to the vent. In the final analysis, the size of tank is not so important providing there is a free discharge through overflow and vent outlets of ample size. If, for example, the sewer is small or without a good grade, the tank should be of larger size. Where cooling water is used, the tank must be large enough to handle both blow down and cooling water. Should the law require an independent blowoff line from each boiler to tank, then the tank would no doubt be set vertical in a central location and the number of blowoff pipes around the circle, together with a manhole in the center, would fix the diameter of the tank.

Design Pressure for the Tank

Water hammer, and sudden pressures from a blowoff valve opened too quickly, or from more than one blowoff opened at a time, are the main causes of excess pressures in a blowoff tank. Application of a sudden pressure creates a bursting effect that is much greater than one produced by the same pressure applied gradually. Pressure also builds up before a free flow of water goes out the sewer. For these reasons, and to make allowances for the corrosion of iron, it is imperative that a tank be constructed of ample thickness. The design pressure is somewhat of a question. A leading insurance company specifies one-half the boiler design pressure and most practice goes along with this.

If a tank is not vented as specified in the requirements for tanks, it is customary to stipulate that the tank be designed and constructed as required for full boiler pressure and to have a safety valve or valves of sufficient capacity to prevent excess pressure. The minimum plate thickness of any tank should not be less than $\frac{3}{8}$ in. The tank should be tested hydrostatically for double the design pressure, should be inspected and stamped by a representative of the insurance company, and a certificate of inspection should be furnished to the owner. The tank should not be of cast iron as in Fig. 1.

Periodic Tank Inspection is Necessary

Failure to clean out or inspect a tank at regular and proper intervals may result in an explosion, even though the stoppage is only momentarily. Mud and scale should be removed periodically, as required, to prevent destructive corrosion of the lower parts of the tank and to avoid any chance of plugging the outlet. A manhole, therefore, is required to facilitate inspection and painting of the tank's interior. The manhole should be located in the upper head or shell and should be equipped with a yoke and gasket. Note that Fig. 2 shows no manhole and that design is therefore objectionable in at least this respect.

A blowoff tank set below the floor should have sufficient space all around for painting and inspection of the entire surface. Inspection should be made in-

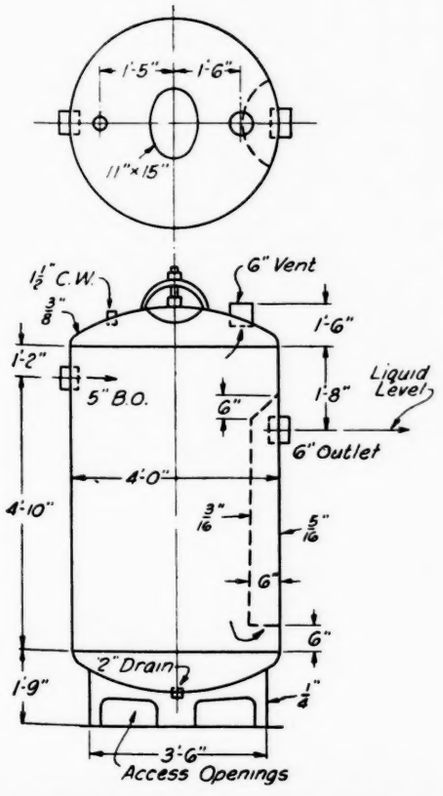

Fig. 3. A good design for a blowoff tank using an internal seal as part of the tank.

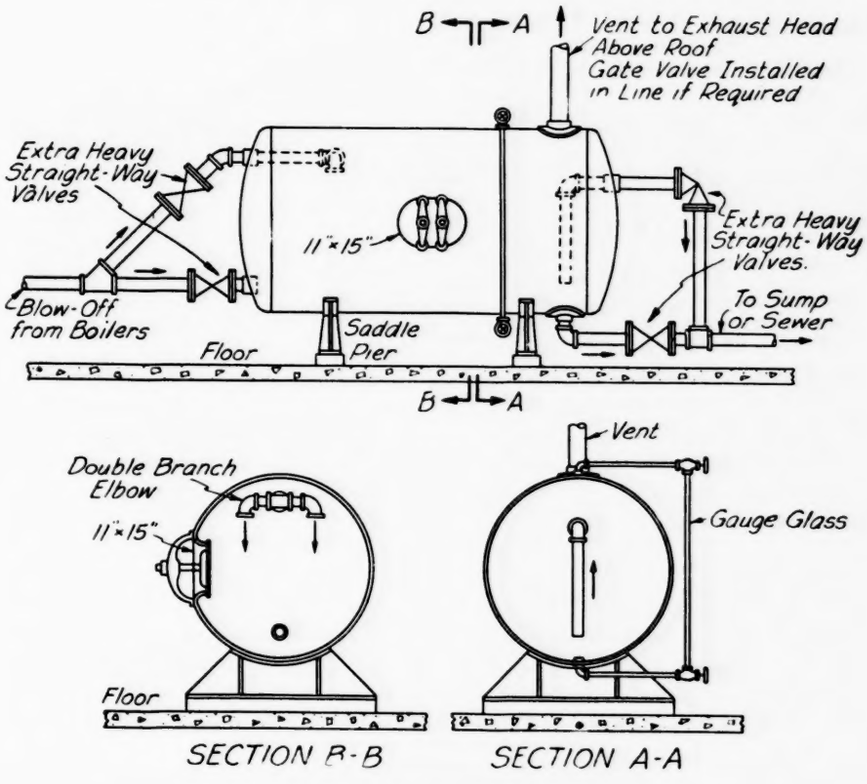

Fig. 4. Blowoff tanks using valves. This is not considered a safe design.

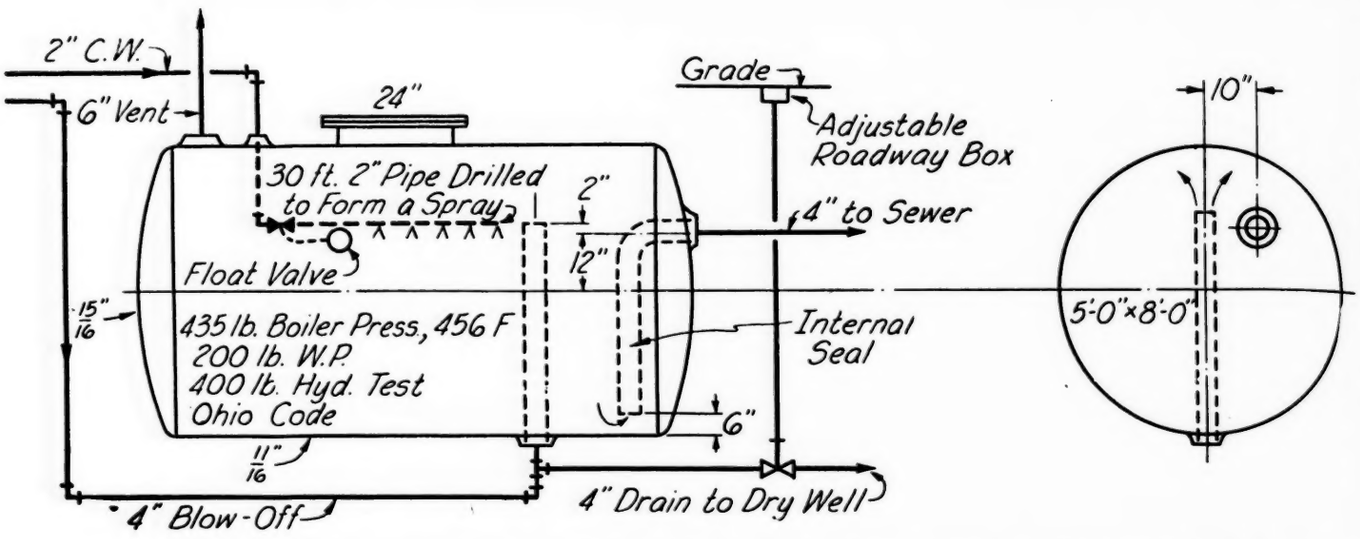

Fig. 5. Blowoff entering the bottom of a blowoff tank. Tank to be inspected and stamped by the insurance company, and certificate of inspection to be furnished. Tank to be welded in accordance with paragraph U-69 of the ASME code.

ternally and externally by a competent inspector. Note openings in the attached supporting stand of the tank shown in Fig. 3. These are for the purpose of inspecting the exterior of the bottom of the tank. Note also that the tank shown in Fig. 1 is below the floor and therefore cannot be inspected externally. The use of a gauge glass (See Fig. 4) is questionable. It is apt to be broken. Incidentally, the supporting stand can be more easily made of angle iron if desired, which method also gives more access to the bottom of the tank. The angle iron supports at the floor can be protected from corrosion by setting them in small concrete bases so as to keep the metal dry. A floor drain should, of course, be set in the pit, located at one side of the tank convenient for clean-out of the drain.

A blowoff tank should be given a good coating of protective paint internally and externally and this coating should be renewed from time to time when the boilers are out of service so that the tank can be thoroughly dried out. If there is a good sized masonry chimney not far from the tank, the vent from the tank can be terminated within the chimney with upturned ell. Same municipal ordinances do not allow discharge to a chimney. Discharge to a steel stack would not be advisable due to moisture from steam combining with soot to form sulfuric acid.

Size and Kind of Piping

The main blowoff pipe is sized according to the sum of the pipe areas connecting to it while the tank vent pipe should be at least two times (preferably three times) the diameter of the inlet blowoff main. As for the outlet pipe from the tank, this should be two times the area of the boiler blowoff main or blowoff pipes entering the tank. Piping for boiler pressures above 100 lb per sq in. and up to 200 lb per sq in. should be of extra heavy steel, while valves and fittings should be 250 lb steel.

The expansion and contraction due to rapid changes in temperature, and the action of water hammer create a great strain upon the entire blowoff system. This is more pronounced when a number of blowoff pipes are joined in one common discharge. Therefore, the blowoff piping should be made up with bends or Y fittings; the number of turns should be limited; the flow kept in one general direction and as direct as possible; and there should be provision for proper expansion, drainage and support. Any pipe within the boiler setting should have fire brick protection with the opening through the setting providing for free expansion and contraction of the pipe. The main is usually run in a concrete trench covered over with a cast iron checkered plate or subway grating divided into short sections. Where a concrete basin is used, the entering blowoff should spend itself against a cast iron plate embedded in the concrete to prevent erosion of the concrete.

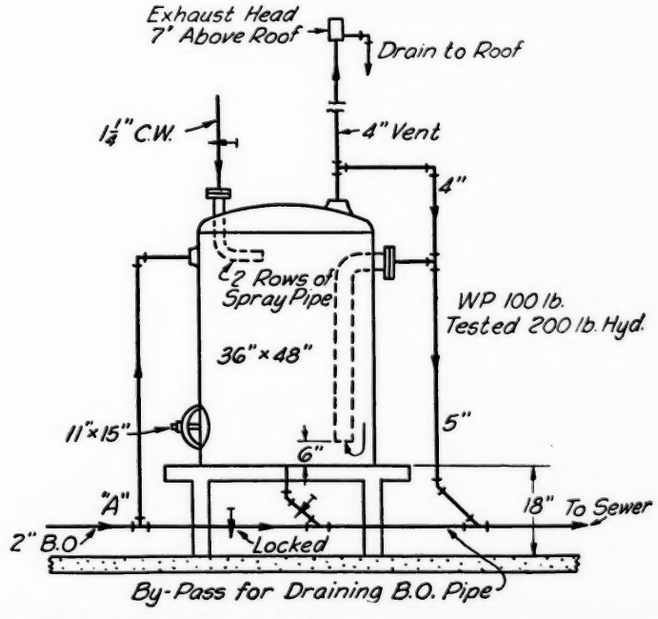

Fig. 6. Blowoff tank with blowoff rising at tank but arranged for drainage of blowoff line.

The inlet pipe should enter the tank at a somewhat higher level than the highest point of the outlet pipe so that no water hammer can take place or water back up into the inlet pipe. Inlets and all piping should be arranged so that they do not blow back mud, scale or water into one another. There should be a full size valved by-pass to the sewer for emergency use. The inlet pipe should not discharge down or up through the water to disturb the water or create water hammer. An inlet pipe turned down into the water will suck back water when under vacuum, thus requiring a vacuum breaker or a check valve which should not be used.

Fig. 4 shows the blowoff pipe with double branch ell turned down and the alternate blowoff through the water, Fig. 2 and 6, the objectionable short radius fittings; Fig. 2, the blowoff pipe entering so close to

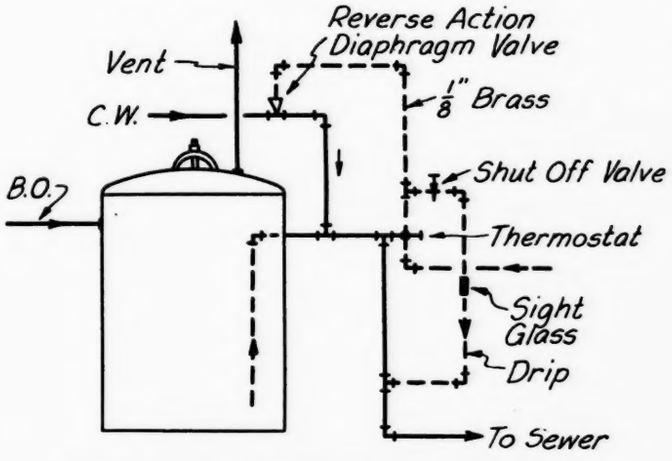

Fig. 7. Thermostatically controlled valve that automatically admits water to blowoff line.

the vent pipe as to block the escape of flash steam through it; and Fig. 8, the rows of ½ in. holes in the blowoff pipe within the tank. In Fig. 5 the blowoff pipe is pocketed and rises through the water in the tank to discharge above the water while in Fig. 2, 4 and Fig. 6 the blowoff pipe also rises at the tank. In such cases a locked and valved by-pass is required as shown for draining water and sludge from the blowoff line. The lock is for preventing someone from thoughtlessly opening the valve while the boiler is being blown down. In other words it is a safety measure. In Fig. 6 the valve in the by-pass should be close to *A*. The blowoff line should not be valved (See Fig. 2 and 4).

Vent Pipe

The great volume needed by the expanding steam as it flashes is largely taken care of by venting the tank at the top near the end opposite the inlet pipe. The vent should then go preferably to the outside atmosphere, to be run as direct as possible with its end terminated not less than 7 ft above any roof or other area. Too small a vent causes water hammer and blows out the water seal within the tank. The larger the vent, the more steam that will flash, but there should be no valve in the vent line as suggested in Fig. 4 and as sometimes done. If the vent is not entirely free, it

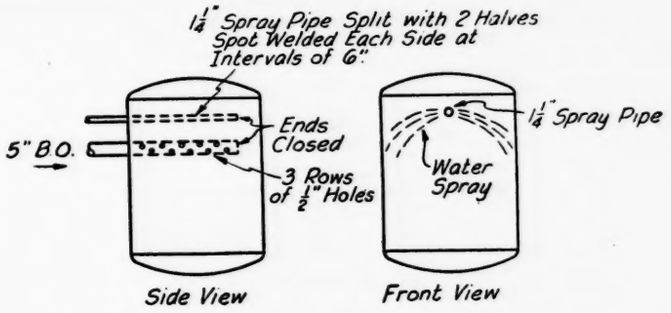

Fig. 8. Two ways of cooling the boiler blowoff.

is possible to subject the tank to full boiler pressure and the tank will then have to be designed for that pressure. In Fig. 4 and Fig. 6 the vent line leads to an exhaust head which again is practically a safety valve and would at least momentarily cause a considerable pressure within the tank.

Water Seal and Outlet to Sewer

The water seal is made to extend internally to within 6 in. from the bottom to maintain a seal that will prevent back flow of sewer gas and will discharge cooler water from the bottom of the tank. The seal will store a certain amount of water for cooling and will give a mixture during blowoff which will not be quite so hot. A good internal seal made as a part of the tank is shown in Fig. 3.

The outlet should be extended full size, and with a good grade or slope to the sewer. Sewers run full at times and will cause dangerous and destructive water hammer should they back water into the outlet or inlet pipes. There should be no valve on the outlet pipe as is sometimes done to allow cooling of the water before discharge to the sewer, (see Fig. 4). Fig. 6 shows a vent to break the siphon and the escape of any flash steam from the outlet pipe. Its use is questionable since it allows any sewer gas to by-pass the water seal and enter the tank.

Fig. 2 shows an arrangement at the outlet which

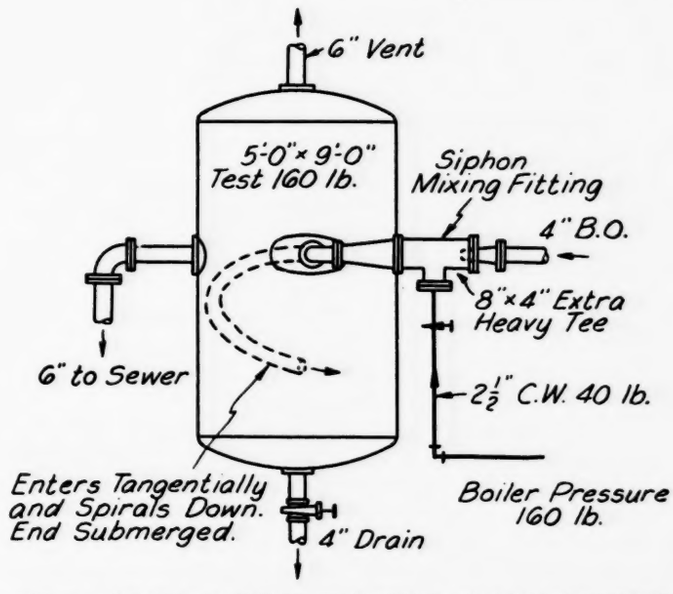

Fig. 9. Method of mixing cold water with the blowoff by means of a mixing fitting installed to prevent water hammer.

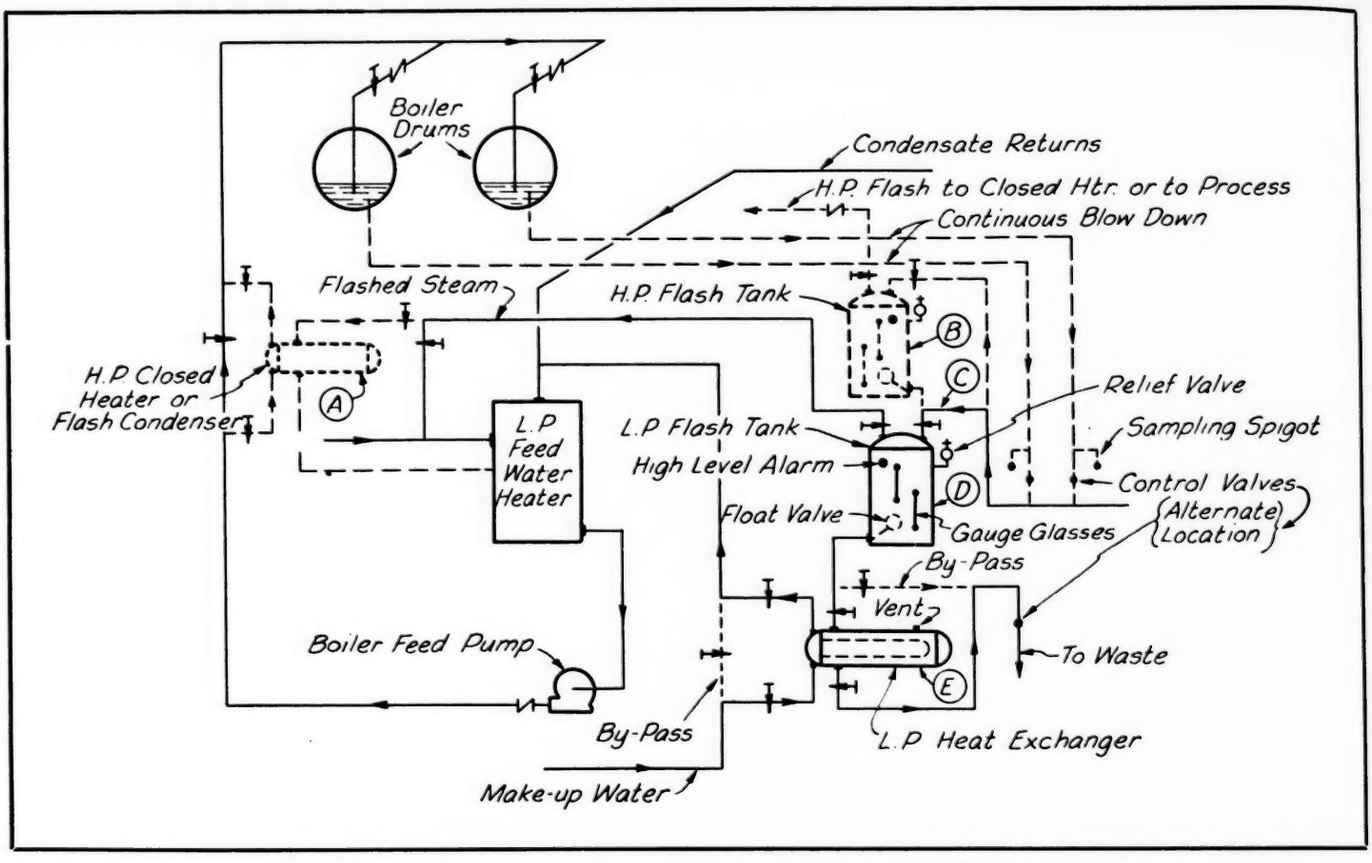

Fig. 10. Continuous blowdown method with additions and alternate designs.

NOTE A: **Add high pressure flash condenser if desired.** NOTE B: **Add high pressure flash tank if desired, with flash to A or to process, and omitting C.**

will also allow the by-passing of sewer gas and should cause water hammer due to mingled steam and water at the crest of the siphon. The 2 in. drain in Fig. 2 is rather small and there is no drain at all in Fig. 1. In Fig. 5 the drain goes to a dry well. The drain outlet should be at the end of the tank farthest from the inlet.

Cooling the Blowoff

The higher the water temperature, the greater the flash and therefore the greater the amount of cooling water required. Again this depends on whether or not excess heat is flashed as steam up the vent, especially where the end of the blow-off pipe is submerged. The spray is introduced in many ways according to the ideas of the particular designer, in Fig. 5, 30 ft of 2-in. pipe is drilled to form a spray, thereby reducing noise and water hammer to a minimum. Sometimes this spray is formed from ½-in. holes on 1½-in. centers. Sometimes there are two rows of spray pipes as in Fig. 6, or the spray pipe may be split with the two halves welded at intervals of 6 in. each side to form a spray as shown in Fig. 8. Such a spray is most effective in a round tank.

Float valves as in Fig. 5 or thermostats as in Fig. 7 are liable to become inoperative in a short time and are more suited to the cooling of hot drips than to the pressure conditions of blow-off. Cooling coils as in Fig. 1 and Fig. 2 are slow in effect and likewise are more suited to the cooling of drip lines only. The siphon or mixing fitting shown in Fig. 9 is for eliminating water hammer.

Advantages of Continuous Blowdown System

Continuous blow-down is much more satisfactory from the standpoint of reducing boiler water concentrations, than intermittent blowdown. In a sizable plant, the occasional or even frequent opening of the blowdown valve is an insufficient and wasteful method. There is a substantial heat loss, the concentration is erratic, and it builds up to a peak before each blowdown. More water must be blown down to insure the necessary reduction and even then the concentration is seldom reduced to the proper extent. With continuous blowdown, the amount of safe concentration is determined in each case and is automatically maintained without heat loss.

Savings depend upon the hours per day and the number of days the system is utilized. They also depend upon the cost and thermal value of the fuel, boiler efficiency, total amount of dissolved solids in the condensate and makeup, safe boiler concentration, total evaporation, and the boiler pressure. The variations in size and number of blowoff control valves and the design of the flash tank, whether ASME or non-code, also affect the initial investment and therefore the savings.

When the boiler concentration is too high, the boiler water is apt to prime and foam. Foaming is a sort of froth that takes up much or all of the boiler steam

space and therefore produces a carryover of moisture. This froth is due to impurities in the water which prevent the bubbles from breaking easily. The surface tension or skin strength of the bubbles is increased by the impurities.

Priming may be due to high fluctuations in boiler load or pressure. Improper equipment or plant conditions may also be the cause, or the steam disengagement area within the boiler may be too small. The amount of priming may sometimes be reduced by better control of boiler operation.

Continuous Blowdown by Various Methods

The equipment necessary for the continuous blowdown costs something, but the cost can usually be written off in a short time, due to the use as desired of one or all of the following methods:

Recovery of flash steam at one or several pressures for various usages, boiler feed water makeup from all or a portion of this steam as condensed, and heat from the unflashed blowdown on its final passage to the sewer.

In the simplest form of continuous blowdown, the several blowdown lines are passed through flow control valves to a flash tank (see *D*, Fig. 10), wherein the reduction of pressure below that of the boilers causes part of the blowdown water to flash into steam. There is no heat exchanger in this method so the unflashed blowdown then leaves the tank and goes to the sewer while the flash steam is discharged into the exhaust or low pressure steam header as connected to the open feed water or deaerating heater. The method cited is least expensive, but recovers only the flash steam.

Another simple method is the use of a heat exchanger (see *E*, Fig. 10) directly in the blowdown line, but without a flash tank. Such a heat exchanger is expensive as it must be designed for boiler pressure. Furthermore, flashing, erosion, and water hammer may occur within the exchanger. Variations of pressure from the several boilers make the control of blowdown more troublesome. Either separate heaters or a divided heat exchanger may be required. This method recovers none of the condensed flash steam for boiler feed water makeup.

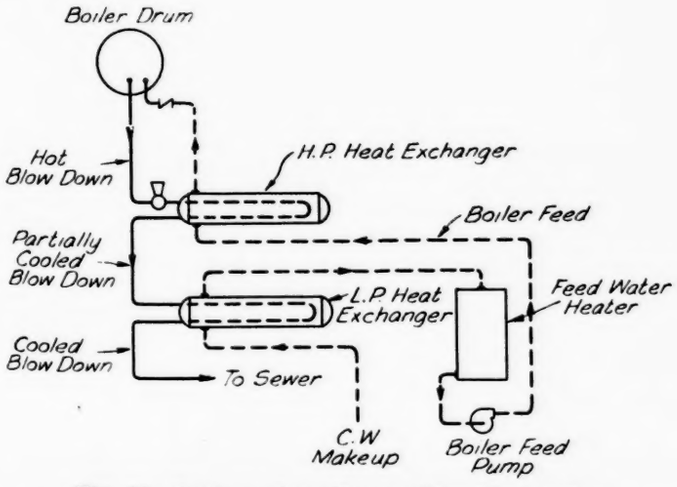

Fig. 11. System of continuous blowdown using two heat exchangers.

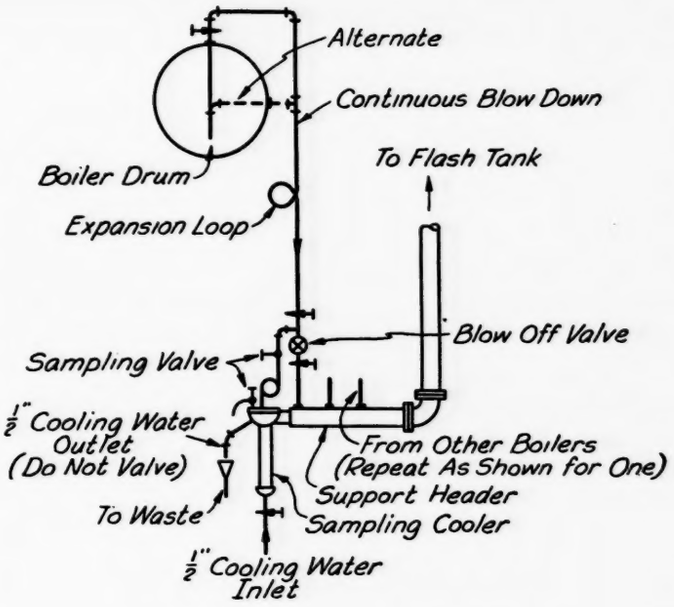

Fig. 12. Arrangement at sample cooler.

Sometimes two heat exchangers are used, one at high pressure, the other at low pressure, as in Fig. 11. The blowdown goes first to the high pressure heat exchanger, the one through which the boiler feed is pumped from the feed water heater. Heat transfer is greatest within this exchanger, because the boiler feed is under pressure from the pumps and the blowdown is the hottest. The partially cooled blowdown then goes to the low pressure heat exchanger where transfer of heat can still be made, because the cold water makeup to the feed water heater is first passed through this exchanger.

A combination of low pressure heat exchanger with a low pressure flash tank (see *E*, *D*, Fig. 10) is less expensive than a system with only a high pressure heat exchanger. The low pressure heat exchanger is smaller as it handles only about half of the available total heat. Furthermore, there is less liability of leakage and tube failures with the lower pressure. This system is used in plants where additional low pressure steam can be utilized.

Where the low pressure steam supply in a plant is sufficient for the heating of space, process and feed water, then a flash condenser is added as at *A*, Fig. 10. In this case, all of the flashed steam goes to the flash condenser (closed heater) where it heats the boiler feed water above the temperature at which it is pumped from the feed water heater. The closed heater need only be designed for the same pressure as the design pressure of the flash tank, which pressure is much less than that of the boilers. This system has the additional advantage of water recovery from the condensed steam. The heat exchanger may or may not be required.

Where the boiler pressure is high, the blowdown is sometimes flashed through multiple flash tanks in as many pressures as can be utilized within the plant. As shown in Fig. 10, the blow down goes first to the high presssure flash tank *B* and is flashed from there to the closed heater or to process. The remaining

blowdown then goes to the low pressure flash tank *D* and is utilized as previously described.

Flash Tank

The flash tank should be designed for proper steam and water velocities, and have a volume sufficient to separate steam from the water to reduce the moisture content of the steam as flashed. It should also be designed for a desired set pressure and provided with a safety valve or valves which will relieve all of the steam flashed at the set pressure from the quantity of blowdown passed by the flow control valves. The safety valves must also relieve the steam from any connected trap discharges, as well as the back pressure from any connecting exhaust lines. Insurance companies may stipulate that the tank be designed for full boiler pressure where safety valves are omitted.

Two flash tanks may be placed at the same level if desired, as there is enough pressure to raise the water from one to the other. The check valve in the outlet from the high pressure flash tank stops backward flow of high pressure steam at such times as the blowoff valves may not be discharging. A water level control valve in the tank insures a constant steam space. This valve is shown at the tank outlet, though sometimes located in the inlet pipe to the tank.

Heat Exchanger

The low pressure heat exchanger should be at least 5 ft below the low pressure flash tank. The blowdown outlet of the heat exchanger should be extended up to an elevation above the exchanger and vented so that the cooling coils will be kept submerged in water. Circulation should be counterflow and preferably through U-tubes, as these are less expensive than straight tubes and give less trouble. The cooling water should be circulated through the tubes rather than in the shell as the velocity of flow is more determinable, as is also the coefficient of heat transfer. Deposits are apt to form on the cool side of the tubes and it is from this side (the inside) that the deposits can be more readily removed.

Heat exchangers become too expensive when designed to cool the blowdown too close to the cooling water temperature. A design with a temperature differential of about 20F is the most economical.

Sample Cooler

The sample cooler, Fig. 12, cools the boiler water to be tested for determination of its concentration. The amount of blowing off is then governed in accordance with the findings of each test. Blowoff valves are of the needle type for throttling as required.

Connections to boilers should be made for the withdrawal of water from that portion of the boilers where water is most concentrated, or as far as possible from the feed water inlet. Low water, as a result of continuous blowoff valves being opened too much, is not likely due to their small size. Nevertheless, the water should be withdrawn at a level slightly above the tubes as a precautionary measure. If the length of blowoff is unusually long, the piping must be increased in size.

Problems to Face in Testing Jet Engines

Reconversion of an 18-year-old brick cell from its original use in testing conventional piston aircraft engines to testing jet-powered engines was recently completed by the Pratt and Whitney Division of United Aircraft. Principal problems encountered were:

(1) the heat of the exhaust, which reaches 1200F.
(2) protection from flying particles from burst turbines or compressors, which travel with the velocity of machine gun projectiles.

These problems were studied jointly by engineers of Pratt and Whitney Aircraft Division and United Aircraft Corporation, and by Albert Kahn Associated Architects and Engineers, Inc., who are architects on this and other Pratt and Whitney expansion projects at East Hartford, Conn.

To meet the problem of heat, unsheathed brick walls were adjudged adequate in the exhaust area. Steel baffles bend the exhaust flow at right angles and direct it upward through an acoustically lined brick stack. At the point of turning, the 1200F at the orifice is reduced to approximately 500F.

Plastic armor is used to meet the problem of protection from flying particles.

The cell is brick construction, 12 ft wide, 40 ft long, and 20 ft high. Two brick stacks project above the roof, one at each end, one for air intake and the other exhaust. None of these specifications in the original structure needed to be changed in the reconversion, except that the stacks were fitted with sliding covers to permit all-weather work inside.

Because the jet engine consists only of compressor, turbine and burner, no special new handling problems were entailed. Engines for test are brought in on an assembly stand equipped with wheels, and a one-ton monorail crane is used for service handling. Engines are moved to the test position through a removable section in the air entrance tube.

Plastic armor is used in the engine area to protect operators and control room. Steel plates are additionally used on the control room side. Two observation ports look out of the control room into the rear of the test area where engineers may examine the exhaust flame.

Some idea of the protective qualities required of the armor is the method of testing turbine rotors before assembly. These tests take place in pits where six inches of steel armor are backed by two feet of solid concrete.

Methods of Joining Pipe

Flanged Pipe Joints

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In this, the second of a group of articles on the methods of joining pipe, the various types of flanged joints are described and uses for each are listed. Article also provides data on gaskets.

FLANGED joints were first developed to supplement screwed joints, but as the advantages to be gained by their use were demonstrated, their application became more general and a wide variety of types and sizes was developed.

They are now available in cast iron, malleable iron, cast steel, forged steel and brass for use with practically all sizes of pipe and for systems operating over a wide range of pressures and temperatures.

Advantages of Flanged Joints

The principal advantages of flanged joints may be summarized as follows:

(1) Their use facilitates erection and dismantling of the piping system.
(2) Parts requiring replacement or repairs may be readily removed.
(3) Blind flanges on the ends of headers or on branch connections permit extensions to the system to be made with minimum cost and interruption in the operation of the system.
(4) No special skill or tools are required to assemble most flanged joints.
(5) No special hazards are involved as in the case of welded joints. It is assumed if flanges are to be welded to the pipe any necessary welding can be done at the shop or in other locations where there is no special hazard due to use of welding equipment.
(6) The use of flanged joints on chemical and process lines in some cases reduces the liability of corrosion.
(7) Flanged materials usually have a higher salvage value than material with other types of joints.

Disadvantages of Flanged Joints

To offset the advantages of flanged joints as listed, the following disadvantages should be considered:

(1) Flanges add to the weight of the piping system, sometimes sufficiently to affect the method of supporting the system.
(2) Greater space must be allowed between adjacent pipe lines, and between pipe lines and equipment or adjacent structures.
(3) For high pressure steam service, when alloy steel piping is used, the cost of flanged joints exceeds the cost of comparable welded joints.
(4) Cost of maintenance is greater than for welded joints.
(5) Flanges add to the difficulties and cost of insulation, and affect the finished appearance of the pipe lines.
(6) Flanges increase maintenance cost of the pipe covering if it is necessary to work on the joints.

Methods of Attaching Flanges

Flanges on fittings, valves and other items of equipment form an integral part of these items but there are three distinct methods of attaching flanges to pipe as follows:

(1) Pipe may be screwed into a shoulder on the back of the flange as shown in Fig. 1 and 2.
(2) End of the pipe may lap over a part of the face of the flange as shown in Fig. 3 and 4.
(3) The pipe may be welded to the flange as shown in Fig. 5 and 7.

Fig. 3 form of lap joint was used satisfactorily for many years but as pressures and temperatures increased, it was superseded by the square corner full thickness lap joint shown in Fig. 4. There are many variations of the three basic types of flanged joints, several of which will be shown and described in this article.

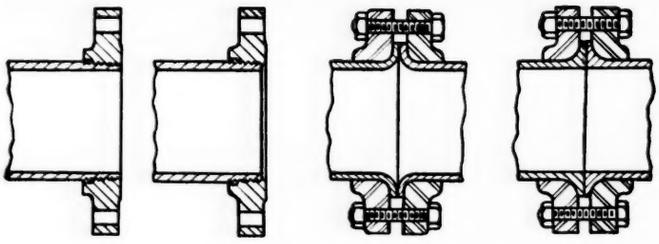
Screwed Flanged Joints

Screwed flanged joints are the least expensive of the several types of flanged joints, and probably the most commonly used. Flanges of this type are available generally in brass, cast iron or steel, and in the last material can be obtained for a wide variety of pressure classifications and in the various standard pipe sizes.

Screwed flanges can be applied to steel, wrought iron, brass, copper or any other pipe which can be threaded, provided the wall thickness is at least equal to that of standard weight pipe in sizes 12 in. and smaller.

For sizes 14 in. and larger the minimum pipe thickness should be $\frac{3}{8}$ in.

Established codes governing the use of material for flanges for various pressures and temperatures are



Left to right, Fig. 1, screwed flange, made on and refaced; Fig. 2, screwed flange, made on but not refaced; Fig. 3 and 4, lapped joints.

based on the strength of the materials and provide adequate factors of safety. These codes can be used without hesitation and in general should be followed.

Screwed flanged joints within the limitations of the codes, and if properly made up, should give satisfactory service for low, standard and medium pressures and moderately high temperatures.

For relatively low pressures and temperatures limited to 450F, screwed flanges may be of cast iron. However, many users prefer steel flanges because they are stronger and less liable to breakage. For higher pressures and temperatures steel flanges should be used.

When making a joint similar to Fig. 1 the pipe is screwed in so that the end projects beyond the face of the flange and after the flange is made on tight, both the flange and the end of the pipe must be refaced to provide a smooth surface.

This is more expensive than the method shown in Fig. 2 in which the pipe is not screwed in far enough for the end to require refacing, but it will provide a tighter joint which is specially important with high pressures.

Limitations of Screwed Flanged Joints

While screwed flange joints that are properly made on, are usually tight at moderate pressures and temperatures, there is always the possibility of leakage through the threads, and as the length of threaded joint is less in Fig. 2 than in Fig. 1, there is much greater possibility of leakage through the second joint than through the first joint.

Threading of the pipe introduces another source of weakness as it reduces the wall thickness of the pipe at the point where the joint is made.

With high pressures it therefore becomes necessary sometimes to use heavier weight pipe than would be required with welded pipe in order to offset reduction in wall thickness.

For certain classes of service the use of light weight pipe is satisfactory, but as its thickness is less than is required for satisfactory pipe threads, some other form of flanged joint must be used. The use of screwed flanged joints is not usually considered advisable for lines handling dangerous fluids or gases, or for hydraulic lines subject to any appreciable shock.

Another disadvantage of the screwed type flange is the necessity for carefully matching the locations of bolt holes on adjoining flanges when making on the flange and before installing the section of pipe in line, as it usually will be difficult when the pipe is in place to screw the flange on any tighter and if the flange is backed off at all it will probably cause a leaky joint. Tightening the flange on the joint shown in Fig. 1 will make it necessary to repeat the operation of refacing.

Lapped Joints

This type of flange has a wide range of utility and application and very few limitations, except its slightly higher cost than for screwed flanged joints.

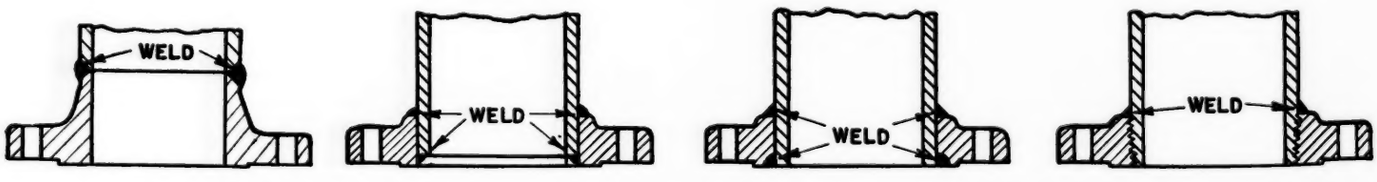
Lapped joints, Fig. 3 and 4, are fabricated in the shop by providing a ninety degree lap on the end of the pipe. This lap should be machined on the face, edges and back, and the flanges should be free to swivel on the pipe. The flanges should always be made of steel as there is a strong possibility that cast iron flanges may be cracked when the bolts are tightened.

Advantages of Lapped Joints

The swivel type flanges simplify the erection of the piping as they may be readily turned on the pipe to make the bolt holes match those on adjacent flanges.

With this type of joint two of the inherent weaknesses of the screwed type flange are eliminated. As no threading is required in this type of joint, there is no reduction in wall thickness, nor is there any possibility of leakage through the threads. The joint is made solely on the finished lapped end of the pipe and not on any part of the flange.

Lapped joints have given satisfactory service over a long period, and are suitable for intermediate and high pressure steam, and for high temperatures for steam and other fluids. They are also adapted for use on large diameter low pressure services where the thickness of metal in the piping is not sufficient for cutting good pipe threads, or where the size of the pipe is such that it is not practical to screw on the flanges sufficiently to insure a tight joint.

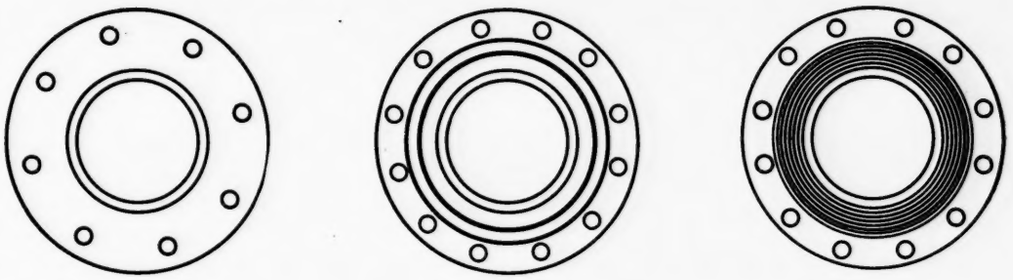


Left to right, Fig. 5, welding neck flange butt welded to pipe; Fig. 6, method of slip-on flange welding—field practice; Fig. 7, method of welding slip-on flange—shop practice; Fig. 8, screwed flange, back welded and refaced.

Limitations of Lapped Joints

Care must be used with 250 lb flanges when tightening up bolts to prevent excessive loads which might fracture the iron flanges.

It is not advisable to bolt a lap joint against any iron flange with a flat face, as furnished for low pressure and standard weight materials. If this cannot be avoided extreme care should be used to prevent breaking the flange on the valve, fitting or equipment.



Left to right, Fig. 9, plain face, smooth finish flange; Fig. 10, plain face, smooth finish, V-grooved; Fig. 11, raised face, serrated finish.

Welded Flanged Joints

With the introduction of welding for piping systems, the welded flanged joint also came into use. Flanges for this type of joint are either the slip-on type, Fig. 7, or the welding-neck type, Fig. 5.

Slip-on type flanges are bored to a snug fit over the pipe and are attached to the pipe by fillet welding at the front and back. Welding-neck flanges have a machined bevel and are attached to the beveled end of the pipe by butt welding.

For field welding of slip-on flanges, the end of the pipe is set back from the face of the flange a sufficient distance to allow for the fillet weld as shown in Fig. 6.

For shop welding, the face of the flange is first specially machined to provide a pocket for the weld and after the welding is complete the face of the flange and the end of the pipe are refaced as shown in Fig. 7.

Screwed flanges are sometimes sealed by fillet-welding the back of the flange to the pipe, thus preventing possible leakage through the threads. Preferably joints of this type should be refaced after welding. Care should be used when welding to prevent distortion of the threads because of the heat generated during the welding operation. This type of joint is shown in Fig. 8.

Advantages and Disadvantages of Welded Flanges

When compared with other types of flanged joints the following advantages are found to be common to both types of welded flanged joints:

(1) Thickness of pipe is not reduced by threading.
(2) The danger of leakage along the threads is eliminated.
(3) Welding flanges are of steel and are therefore suitable for use with higher pressures and temperatures.
(4) When used against cast iron flanged ends of valves, fittings, or equipment especially if these are of the flat face type, then the raised face of the flange may be removed to prevent breakage due to excessive tightening of the bolts when making up the joint. This cannot be done with lapped type joints.

The following disadvantages should also be considered and are common to both types of welded flanged joints:

(1) Welding flanges are higher in cost than cast iron screwed flanges.
(2) Welded flanges, being rigidly welded to the piping, require the same care in the alignment of the bolt holes as is necessary with screwed flanges.

Comparison of Slip-On and Welding-Neck Flanges

Slip-on type welding flanges have many advantages as compared with welding-neck flanges as the following list will indicate:

(1) Slip-on welding flanges are lighter in weight than welding-neck type flanges.
(2) Slip-on flanges are available in a wider range of reducing sizes than welding-neck flanges.
(3) As slip-on flanges match the outside diameter of the pipe, which remains constant for varying thicknesses in any one size, this type of flange can be applied to any schedule of pipe in its size.
(4) With slip-on flanges all of the welding is done on the outside of the pipe, thus preventing the possibility of icicles forming on the inside of the pipe as may occur with welding-neck flanges unless a backing ring is used when welding. If a backing ring is not used, it is good practise to grind the inside of the weld on a welding-neck flange.
(5) With slip-on type welding flanges it is not necessary to bevel the pipe.

Welding neck flanges however have the three following important advantages:

(1) They only require one weld.
(2) They do not require any refacing after the weld is made.
(3) They can be used for high pressures and temperatures, whereas slip-on flanges are not recommended for pressures in excess of 300 lb per sq in., or a temperature in excess of 700F.

Facings for Flanges

The following types of flange facings are commonly used for the services indicated:

(1) Plain face smooth finish. Standard for 125 lb cast iron, semi-steel, or malleable iron screwed flanges. See Fig. 9.

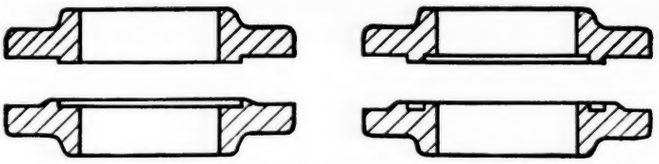


Fig. 12, large male and female facings. Fig. 13, large tongue and groove facings.

(2) Plain face smooth finish V-grooved. Standard for 150 or 300 lb brass flanges. See Fig. 10.

(3) A 1/16 in. raised face serrated finish. Standard for steel flanges, screwed, slip-on or welding-neck flanges, types S-150 and S-300, and for cast iron or semi-steel 250 lb screwed flanges.

(4) A ¼ in. raised face serrated finish. Standard for steel flanges; screwed, slip-on or welding-neck flanges, types S-400 to S-1,500, inclusive.

(5) Large male and female facings. Used for 250 lb cast iron or ferrosteel screwed flanges; 800 lb hydraulic ferrosteel screwed flanges and forged steel flanges of the screwed, or welding-neck types S-150 to S-1,500 and for slip-on flanges. See Fig. 12.

(6) Large tongue and groove facings. For the same types of flanges as for (5). See Fig. 13.

(7) Small male and female facings. For the same types of flanges as for (5). Care should be taken in the use of small male and female facings for joints on lines, where the joint is made on the end of the pipe, to insure that the pipe used is thick enough. Sufficient bearing surface must be provided to prevent crushing the gasket.

(8) Small tongue and groove facings. For the same types of flanges as for (5).

Flanges for ammonia and Freon piping are special forms of this type of flange in which sizes up to and including ¾ in. are oval in shape with 2 bolts, square from sizes 1 to 2½ in., inclusive, with 4 bolts, and round for larger sizes with from 8 to 16 bolts in accordance with the diameter of the flange. See Fig. 14.

(9) Ring joint facings. These can be furnished for 300 lb to 1,500 lb forged steel screwed, or welding-neck flanges, slip-on welding flanges, and lap joint flanges. See Fig. 15.

(10) Lap joint for steel flanges. Used with either smooth finish or approximately 32 serrations per inch for all pressures. See Fig. 16.

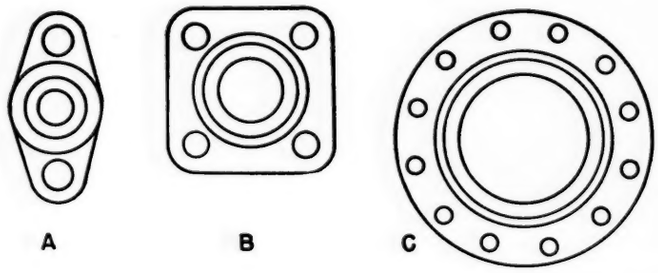


Fig. 14. Forms of flanges for use with ammonia and Freon piping.

The Sarlun joint which is of the lap joint type has a cold water smooth tool finish, and no gaskets are used. Extended lips are provided on the outer periphery of the contact faces and these lips are sufficiently thin to permit fusing by the application of heat without causing distortion of the contact faces. The welding or fusing of the extended lips is performed after the joint has been assembled and tested to prove its tightness. Flanges of this type are forged steel and can be obtained in all standard weights from 300 lb to 1,500 lb pressure. See Fig. 17.

Finish for Contact Surfaces of Flanges

The finish for the contact surfaces of flanges will largely be determined by the type gasket to be used. The most commonly used finish on cast iron and steel flanges requiring low seating pressures is the plain face which is a smooth flat finish.

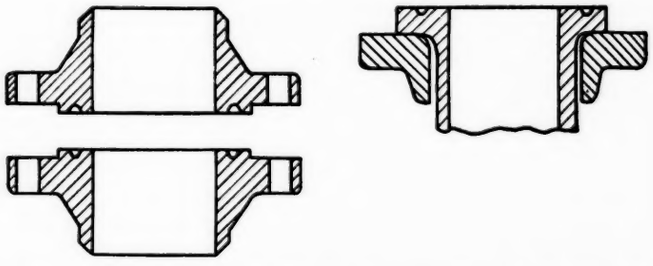


Fig. 15. Ring joint facings which are available in screwed, welding neck, slip-on welding, and lap joint flanges.

For gaskets requiring higher seating pressures, either the serrated finish with concentric grooves spaced approximately 16 to the inch for cast iron or ferrosteel, or 32 to the inch for forged steel flanges is used. In place of concentric grooves the phonographic finish with continuous spiral grooves is sometimes used. These grooves are usually in the male face and the female face generally has a smooth finish.

For use with metal gaskets, ground or lapped joint surfaces are commonly used.

For metal to metal joints such as Sarlun joints where no gaskets are used, a very smooth mirror-like finish is necessary, which can best be obtained by grinding and lapping.

Gaskets

While it is possible to obtain tight joints even with high pressures and temperatures without the use of gaskets, it is more economical in most cases to provide some form of gasket which under the pressure developed by tightening the bolts, will flow into the imperfections in the ordinary plain face finish, or the machined recesses provided with other types of finish, and thereby make a fluid tight seal.

There are no fixed rules for determining the types of gaskets to be used for various pressures and temperatures, but the information given in Table No. 1, from data furnished by a nationally known manufacturer of valves and fittings, will be found very helpful as a guide in the selection of suitable gasket materials.

Gaskets may be of the full faced type for use with

Table 1 – Types of Gaskets and Their Average Use

Gasket	Steam LP LT	Steam LP HT	Steam HP LT	Steam HP HT	Water LP LT	Water HP LT	Gas and Air LP LT	Gas and Air HP LT	Oil LP LT	Oil Vapor LP HT	Oil Vapor HP LT	Oil Vapor HP HT	Refrigerants LP LT	Refrigerants HP LT	Chemicals LP LT	Chemicals LP HT
Soft rubber sheets with or without cloth reinforcement	..	..	..	..	x	..	x	..	..	..	..	..	x	..	..	..
Hard rubber sheets with or without cloth reinforcement	..	..	..	..	x	..	x	..	..	..	..	..	x	..	..	..
Fibre sheets	..	..	..	..	x	x	x	x	x	..	x	..	x	x	..	..
Asbestos composition	x	x	x	..	x	x	x	x	x	x	x	..	x	x	..	..
Corrugated metal and spiral wound metal with asbestos	x	x	x	x	x	x	x	x	x	x	x	x	x	x	..	..
Corrugated metal jacket asbestos filled	x	x	x	x	x	x	x	x	x	x	x	x	x	x	..	..
Corrugated metal: copper	x	x	..	..	x	x	x	x	x	x	..	..	x	..	..	..
Corrugated metal	..	..	x	x	x	x	x	x	x	x	x	x	x	x	..	..
Flat metal jackets asbestos filled	x	x	x	x	x	x	x	x	x	x	x	x	x	x	..	..
Solid metal: Aluminum	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Copper	x	x	x	..	x	x	x	x	x	x	x	x	x	x	..	..
Iron, monel, steel alloy	x	x	x	x	x	x	x	x	x	x	x	x	x	x	..	..
Plug Type Gasket	..	..	x	x	x	x	x	x	x	x	x	x	..	x	..	..

Temperature and pressure ranges for gasket table:
Low temperature, up to 400-500F; high temperature, 500-1, 200F.
Low pressure, up to 400-600 lb per sq in.; high pressure, 600-2,500 lb per sq in.

Rubber is not suggested for use above 300F.

Fiber is not suggested for use above 500F.

Asbestos is not suggested for use above 800F.

plain face cast iron flanges for low pressures and temperatures and are always used for brass flanges as their use reduces the danger of distortion or breakage of the flanges when tightening the bolts.

Full face gaskets are usually furnished without punching for the bolt holes unless otherwise specified, and an extra charge is made for this service if ordered.

Ring gaskets cover the face of the flange from the edge of the opening to the inside edges of the bolts, and are usually furnished unless full faced gaskets are specified.

Flanges with ring joint facings use a steel ring fitting into a specially designed groove in the faces of the flanges and no gasket other than the ring is needed.

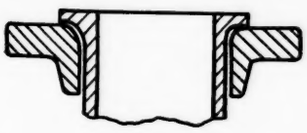


Fig. 16.
Lap joint for steel flange.

Gaskets for use with ammonia or other gases or liquids, which might constitute a serious hazard in case of blow-out are usually protected by the use of flanges with tongue and groove facings. This type of facing not only reduces the possibility of blow-out, but also protects the gasket from action of the material being conveyed through the piping system.

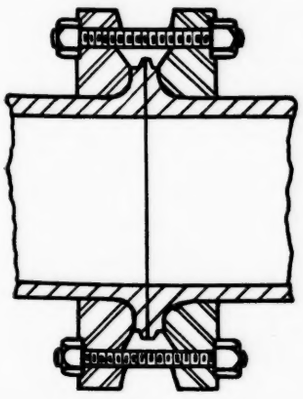


Fig. 17. Sarlun joint.

Bolts for Flanges

In order to make a tight joint between adjacent flanges it is necessary to pull them together with sufficient pressure not only to seat the gaskets against the contact surfaces of the flanges but also to overcome the thrust due to the internal pressure on the system which tends to separate the flanges. The seating pressure required in pounds per square inch of contact surface will vary with the type of gasket used as shown in Table 2.

The excess pressure over the seating pressure required to insure joints that will not leak is commonly expressed in the form of a ratio between the unit pressure existing upon the contact area when the internal pressure is exerted upon the flange, and the internal fluid pressure. This ratio is called the "residual contact pressure ratio". The required ratio is dependent

Table 2 – Seating Pressure for Gaskets

Gasket Material	Seating Pressure, Lb per Sq In.	Remarks
Soft rubber sheets	500	Add 250 lb per sq in. for cloth reinforcements
Hard rubber sheets	750	Add 250 lb per sq in. for cloth reinforcements
Fiber sheets	2,000	
Asbestos composition	4,500	No addition for reinforcements
Corrugated and spiral wound metal with asbestos	4,500	
Corrugated metal jacket asbestos filled	6,000	
Corrugated metal—copper	6,000	
Corrugated metal—monel, steel and iron	7,000	
Flat metal jackets, asbestos filled	7,000—9,000	
Solid metal—aluminum	10,000	
Copper	14,000	
Iron and monel	18,000	
Steel alloys	21,000—25,000	

Table 3 — Average Residual Contact Pressure for Gaskets

Gasket Material	Average Residual Contact Pressure Ratio	Remarks
Soft rubber sheets	1.00	Add 0.25 for cloth reinforcement
Hard rubber sheets	1.25	Add 0.25 for cloth reinforcement
Fiber sheets	2.00	
Asbestos composition	3.00	No addition for reinforcement
Corrugated and spiral wound metal with asbestos	3.00	
Corrugated metal jacket asbestos filled	3.50	
Corrugated metal—copper	3.50	
Corrugated metal—monel, steel and iron	3.75	
Flat metal jackets, asbestos filled	3.75—4.25	Lower values are for soft metals; the higher for steel alloys, etc.
Solid metal	4.50—7.00	A 6.00 ratio is customary for soft iron. A 4.50 ratio is used for aluminum only.

Use of these listed operating residual contact pressure ratios is predicated upon the gasket being properly seated previous to putting the flange joint into operation. Pressures required for seating of the different gasket materials and types are given in Table 2.

upon the material and form of the gasket and also upon the nature of the contained fluid. It is customary only to distinguish between gases and liquids with no differentiation for the physical and chemical properties of the fluid. For gases this ratio is required to be twice as much as for liquids. The ratios listed in Table 3 have proved satisfactory for operating conditions for a gas. For liquids, no residual contact pressure ratio should be less than one.

The seating pressures and residual contact pressure ratios given pertain to the gaskets but are applied to the flange contact area. Where contact surfaces on flange facings are serrated, a flange contact surface coefficient is used. If only one flange is serrated, this coefficient is 0.75 and if both are serrated the coefficient becomes 0.50.

The American Standards for bolted flanges are based on the use of studs with two nuts. The studs are threaded full length and for severe services the threads are sometimes ground threads.

Studs commonly are provided with American National Standard screw threads, coarse thread series up to and including 1 in. diameter and with American National Standard screw threads (8 threads per inch) for larger sizes.

With high temperature systems it will sometimes be found that the temperature of the bolts may be lower than that of the flanges and they will not expand to the same extent as the piping system. This will tend to make a tighter joint but will also put severe strain on the bolts.

For refrigeration systems operating at temperatures below zero, the opposite condition will hold. The bolts being at a higher temperature than the piping systems, will tend to allow the joints to open up and cause leakage.

References

For further information on flanged joints the reader is referred to the following sources of information:

Crane Co. Catalog No. 52

Walworth Co. Catalog No. 42

Tube Turns Catalog & Engineering Data Book No. III

Check List for Ventilating Systems

Since ventilating equipment in the solvent department provides basic protection from health and fire hazards, it should be inspected regularly. To eliminate the five most common causes of failure of ventilating equipment the Safety Research Institute recommends the following points should be checked:

Is the Fan Running Backwards? Strangely enough, the Institute claims this is the most frequent reason for failure of correctly designed equipment. Sometimes a fan requires repairs, and then is reversed when it is started up again. A regular check on the direction of fan motion is important.

Is the Fan Belt Loose? Loose belts cause the fan to run too slowly. Since new belts generally loosen up somewhat after use, they should be adjusted after installation.

Is the System Overloaded? While a system may be correctly designed for the initial load, it often happens that additional outlets are later added, reducing the overall efficiency of the equipment. The velocity of the air stream should be measured regularly, and whenever additional ducts are added.

Are the Ducts and Blades Dirty? Dirt in a ventilating system is a frequent cause of breakdown and inefficient operation. Systems should be cleaned regularly. Fans should be run for a few minutes after operations are finished, to allow for complete emptying of the ducts.

Is There Insufficient Make-Up Air? Since ventilating equipment exhausts air, it cannot run efficiently unless there is provision made for enough make-up air to enter the room.

HEATING AND VENTILATING'S
Reference Section

Progress Report on Ventilation for Cotton Textile Processes

LESLIE SILVERMAN and FREDERICK J. VILES, Jr.
Harvard School of Public Health

Progress Report on Ventilation for Cotton Textile Processes

LESLIE SILVERMAN
Assistant Professor of Industrial Hygiene, Harvard School of Public Health, and

FREDERICK J. VILES, Jr.
Research Fellow, Harvard School of Public Health, Boston, Mass.

A study is now in progress at the Harvard School of Public Health to determine atmospheric concentration of air contaminants in cotton textile mills; ventilation requirements for cotton textile processes; improved methods of controlling dust and air-borne lint. The study is also interested in improving methods of cleaning cotton for processing since such betterments will decrease air contamination and increase processed cotton production. This is a progress report of that investigation. Work on that investigation is supported by a Nashua Manufacturing Co. and Saco-Lowell Shops gift to the Harvard School of Public Health.

DUST and lint control in cotton textile mills is desirable to improve general air conditions, to maintain workers' health, and to eliminate nuisance dusts from the workroom. This control is also desireable from the manufacturing standpoint, since it improves the quality of the product and reduces seconds.

Although the health problems in cotton textile mills may be considered as minor, two such problems exist. One is described as cotton mill fever, possibly a foreign protein reaction which results from exposure to cotton dust, and the other byssinosis, a lung condition resembling pneumoconiosis, which results from prolonged exposure (20 to 25 years) to fine dust and lint (short fibers) in the air of card-rooms. Both of these conditions are readily eliminated by the installation of proper ventilation.

Our study is aimed primarily at engineering control of dust and lint in order to improve the processing of cotton and to eliminate the nuisance and maintenance problems created by cotton dust. This report is preliminary and is confined to cleaning processes in the manufacture of cotton products. These processes are opening or bale-breaking, picking, and carding. They are common to yarn mills, absorbent cotton manufacture and processing of cotton for mattresses, pillows and upholstery.

A brief description of each of these processes is included for the benefit of those not familiar with the manufacture of cotton products.

The majority of cotton mills in this country use domestic cotton of various grades, depending upon the product manufactured. Long staple cotton is desirable for spinning into yarn for high quality products such as braiding and sheeting; medium staple cotton is used for medium quality products such as cotton cloth and cotton fabrics; short staple and stained cotton, in which color and appearance are not at a premium, are used for sash cord manufacture, stuffing, absorbent cotton production and similar products.

Cotton at present is usually hand picked, but in spite of this fact it contains considerable amounts of leaf fragments, field dirt and organic materials such as pollen, insects, and bacteria. An increasing amount of cotton is now picked by machine, and this cotton also carries the same contaminating materials in greater amounts.

Picked cotton is ginned to remove seeds and during the ginning operation, seed fragments are added to the cotton as contaminants. After the cotton is ginned it is compressed into high density bales and shipped to a storage point and later to the cotton mill. During shipment the cotton bale is also contaminated by dirt, even though the bale is partially wrapped by burlap cloth.

When the cotton arrives at the mill, it is necessary to break the baled cotton into small bunches for cleaning. This is accomplished by the bale breaker or opening machine, a device which is essentially a feed belt supplying the cotton to another belt equipped with sharp spikes which tear the compressed cotton layer into small bunches. During this process considerable leaf trash and dirt are released because of the tearing and jarring action in bale breaking. Bale breakers are not designed to clean cotton, but because of their action, considerable air contamination is created in their immediate vicinity.

From the bale breaker the cotton is usually conveyed pneumatically to the pickers. Cotton pickers are of

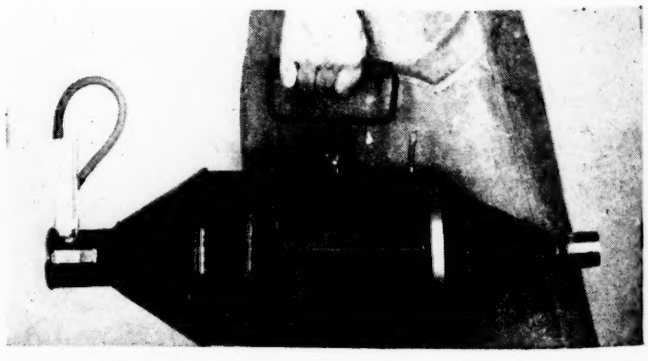


Fig. 1. High volume sampler for taking rapid samples of air contaminants in cotton textile mills. Metering orifice is at rear.

Photo, preceding page, by Harold M. Lambert Studios

several types, but are usually whirling blades and paddles which beat and pick at the cotton clumps. Three principal types of pickers are employed; breaker-pickers, intermediate-pickers, and finisher-pickers. This beating and picking operation frees the cotton of some of the leaf trash and dirt which it contains. The leaf trash particles are much harder to remove than the fine dust and small leaf and organic fragments since the tenacles of the cotton fiber tend to enmesh the large particle and holds it to the cotton. The picker is usually provided with a lapper which forms the picked cotton into a long lap which is wound around an axle for moving to the carding machine.

The carding machine or carding engine is a device which is similar to a mechanical comb and it draws the cotton lap into a round continuous strip or "sliver" of parallel fibers from which the cotton may be spun into threads. Carding produces a large amount of fine dust and short cotton fibers (lint).

Sampling Methods

Air contamination in these textile processes has three principal components; cotton fibers, usually short fine fibers designated as lint; organic trash, principally small fragments of dried leaf, small pieces of cotton plant, and seed bits—this material is called "pepper trash" in the mills; and dust from dirt carried by the cotton from the field, from shipping cars and storage.

In order to sample the air and determine these components we have developed a new sampling apparatus which is designated as the Hi-Vol (high volume) sampler. This device, shown in Fig. 1 and 2, consists of a filter holder supporting a simple pleated filter unit, Fig. 3, of compact design which has an area of 83 sq in. Filters are fastened to the filter holder by a simple screw retaining ring which houses a small blower unit. Blower discharge passes through a metering orifice or a direct reading propeller type meter. This device samples air at a rate of 50 to 80 cfm, depending upon the accessories used. The funnel cover shown in Fig. 1 is used for protection in carrying and for duct sampling in conjunction with a length of hose. The pleated filters are made of unimpregnated cellulose and have been found experimentally to retain 100% of cotton mill dusts. The collected filter samples are analyzed for total contaminants, organic trash and dust.

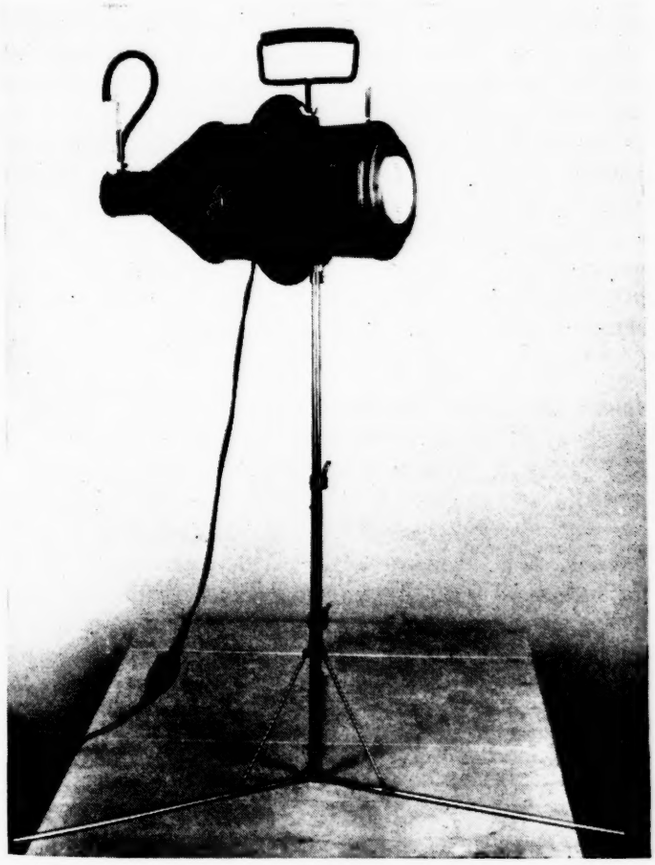


Fig. 2. High volume sampler mounted on a tripod in sampling position.

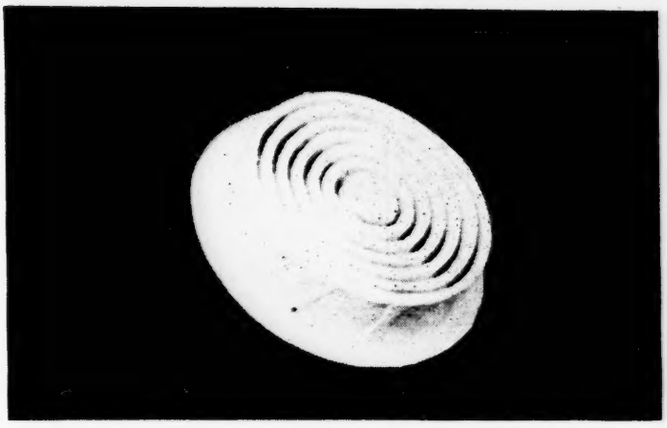


Fig. 3. Pleated paper filter used for removal of contaminants from air sample.

In order to ascertain the cleaning efficiency of the processing machine, material samples of the cotton entering and leaving the machine are obtained. These samples are analyzed for organic trash and dust. Particle size of the visible trash is obtained by dissolving the cotton sample in 60% sulfuric acid.

Air Contamination in Different Processes

The amount of air contamination in cotton textile processes is dependent upon the amount of trash and dirt in the cotton. Visual inspection of cotton mills shows that higher grades of cotton, which are cleaner and of longer staple length, create less air and plant

Table 1 — Grade and Manufacturing Waste

No.	Grade	Average Picker and Card Waste— % of Total Cotton Weight
1	Middling fair	5.50
2	Strict good middling	5.80
3	Good middling	6.35
4	Strict middling	7.17
5	Middling	7.77
6	Strict low middling	8.94
7	Low middling	11.13
8	Strict good ordinary	13.15
9	Good ordinary	15.66
10	BG (below lowest grade)	18.79

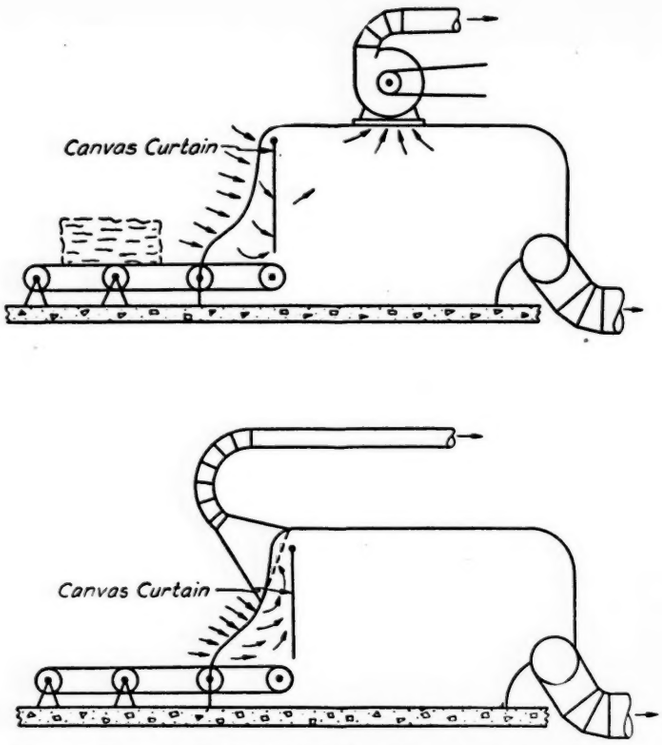


Fig. 4. Two methods of ventilating opening machines or bale breakers. This and Figs. 6 and 8 are courtesy of Steel Heddle Mfg. Co., Philadelphia, Pa.

contamination. Table 1 gives the amounts of picker and card waste obtained by analysis of the operation of cotton cleaning machines. These data were obtained by weighing the amount of trash recovered in the machine as a proportion of the weight of cotton supplied. The waste percentages represent comparatively mild cleaning of cotton at the picking process and thorough cleaning during carding.

Air contamination of opening rooms in relation to material contamination and ventilation is shown in Table 2. These air concentration figures are mean values corresponding to several determinations made in each location. From these data it can be observed that unventilated bale breakers create contamination ranging from 5.1 to 22.8 mgs per cu m, depending upon the amount of trash and dust in the material. The material sample data are mean values obtained from the cotton stock supplied to the breaker. The percentage of trash in the air sample appears to be independent of the amount in the material. In the case of ventilated bale breakers the relationship between material and air contamination is also evident, but not as markedly as in the unventilated breakers.

Air concentration in picking operations are shown in Table 3. The general room air concentrations are lower because a significant amount of trash and dirt are removed during bale breaking operations. Samples taken in Mill No. 1 correspond to two different rooms —a preliminary picking room and the final picking and lapping room. Results of these samples indicate that final picking creates less air contamination. This may be attributed to the fact that the cotton handled by the final picker contains less foreign material. Values for Mills No. 2 and 3, where all the picking is done in one room by a series of Spirawhirl pickers

Table 2 — Relation Between Air Concentration and Cotton Contamination in Opening Rooms

No.	Air Concentration			Material Concentration	
	mgs per cu m	% Trash	% Dust	% Trash	% Dust
Unventilated Bale Breakers					
1	22.8	23.1	9.4	4.3	2.8
2	5.1	20.7	—	0.45	1.7
Ventilated Bale Breakers					
1	13.9	—	—	4.0	1.4
2	5.2	19.8	17.4	3.3	1.6

followed by a lapper, indicates that there is more contamination at the inlet to these pickers than at the outlet. Results for Mill No. 3, using a better grade of cotton than No. 2, are much higher than expected, but we believe this difference was created by operators blowing off the machine with compressed air just prior to sampling. This blowing operation, which is a familiar practice in cotton mills, should be discouraged because it results in unnecessary air contamination, and the dispersed dust merely settles again in the same locations.

No attempt is made to collect or vacuum clean this dust in most mills. Operators simply blow the dust and lint away from moving parts and the machines. Some attempt should be made to vacuum clean or sweep this contamination away rather than re-disperse it. Even in these samples, however, the inlet end of the picker indicates greater contamination. A material study of the pickers in Mills 2 and 3 indicates that the first-stage picking operation removes the greatest amount of trash and dust.

The second-stage picker and lapper contribute very little to trash and dust removal, which confirms the data of Table 3. A comparison of Table 3 with Table 2 shows that the amount of organic trash in the air is much less in picking than in opening. There is approximately one-half as much organic trash in the air samples collected in the picking locations.

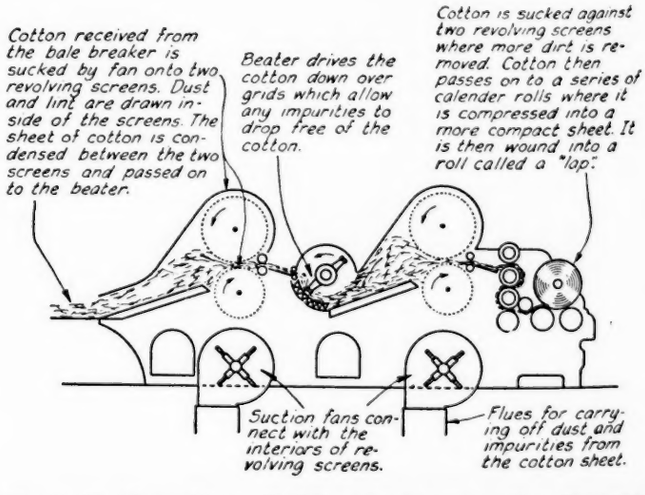

Cotton received from the bale breaker is sucked by fan onto two revolving screens. Dust and lint are drawn inside of the screens. The sheet of cotton is condensed between the two screens and passed on to the beater.
Beater drives the cotton down over grids which allow any impurities to drop free of the cotton.
Cotton is sucked against two revolving screens where more dirt is removed. Cotton then passes on to a series of calender rolls where it is compressed into a more compact sheet. It is then wound into a roll called a "lap."
Suction fans connect with the interiors of revolving screens.
Flues for carrying off dust and impurities from the cotton sheet.

Fig. 5. Breaker-picker. Paddle wheel type suction fans are used for removing trash during cotton cleaning.

Table 3 — Air Concentrations in Picking Operations

Mill No.	Air Concentration		Location
	mgs per cu m	% Trash	
1 Middling cotton	5.4	—	General room air. Blenders and Spirawhirl pickers.
	2.2	—	General room air. Final picker and lapping.
2 Middling cotton	3.6	8.3	Room air at inlet to picker-lapper.
	1.6	9.8	Room air at outlet to picker-lapper.
3 Good middling cotton	12.1	5.4	Room air at inlet to picker-lapper.
	2.5	11.9	Room air at outlet to picker-lapper.

Concentrations of air contaminants during carding are presented in Table 4. These samples indicate that air concentrations in carding are equal to and are higher than those in picking rooms. Carding room samples are also affected by compressed air blowing for cleaning of the carding machines. The fine dust which is dispersed in the air takes considerable time to settle and creates considerable air contamination. This blowing operation is done after every eight-hour shift, and sometimes more often. The carding samples also show that the air concentration is greatest at the outlet end of the carding engine. Samples at Mill No. 3 are an exception, but are believed to be influenced by blowdown.

It is logical to expect more contamination at the outlet end of the carding engine since it is here that the fibers are drawn parallel and then contracted into a sliver. Visual inspection of the drawing operation indicates lint generation, which dust generation must accompany. The percentage of organic trash in the cardroom samples appears to be about the same as those for samples obtained in picking rooms.

Methods of Ventilating

Before discussing cotton process ventilation, it is of interest to mention the use of direct methods of controlling air contamination. The only method of controlling contamination which has been applied in opening rooms is the use of a light oil spray which is sprayed on cotton on the bale breaker. It is claimed that this spray keeps down dust. We have had an opportunity to deserve this in one mill which discarded its ventilation on the bale breaker and substituted an oil spray. Preliminary air sampling investigation indicates that this may reduce the air concentration significantly; however, further work is indicated. Some mill operators agree that oil reduces dust, but contend that cotton treated this way is more difficult to spin and results in greater breakage. Apparently this is a moot point, since some mills are successfully using oiling in routine production.

One other possible method which has not been applied is the use of moisture conditioning of cotton before bale breaking. It is known that the effect of moisture is to increase the coefficient of friction be-

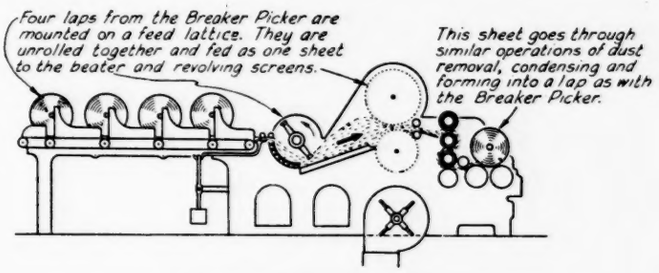

Four laps from the Breaker Picker are mounted on a feed lattice. They are unrolled together and fed as one sheet to the beater and revolving screens.
This sheet goes through similar operations of dust removal, condensing and forming into a lap as with the Breaker Picker.

Fig. 6. Intermediate picker.

tween cotton fibers since greater strength results with high rates of moisture absorption. It appears possible that conditioned cotton will not result in as much air contamination, at least with respect to lint.

The cotton textile industry is unique in that it has perhaps the largest floor space per worker of any industry. This makes recirculation of exhausted air desirable to reduce heat losses. Another fact that is significant is that pneumatic conveying is widely used in transporting cotton from opening operations to picking.

The number of machines used in opening is small; the number of pickers larger, and the number of cards much greater. For 3 openers, perhaps 8 or 10 pickers and 40 of fifty carding engines are necessary. Thus the amount of ventilation to be installed increases with each operation.

Opening Room Ventilation

In this discussion only local exhaust of the cotton processing machines will be considered. In the majority of opening rooms, local exhaust is the only means provided for process ventilation. Fig. 4 shows two methods which have been observed for bale breaker ventilation. In one (top of Fig. 4) the bale breaker is ventilated directly by a small paddle wheel type exhauster which discharges to a cyclone type collector outside of the opening room or to the dust house—which is a large settling chamber. This fan exhausts

Table 4 — Air Concentrations in Carding Operations

Mill No.	Air Concentration			Location
	mgs per cu m	Trash %	% Dust	
1 Middling cotton	4.1	—	—	Intake end of 4 cards
	4.4	—	—	Outlet end of 4 cards
2 Middling cotton	8.4	8.1	—	Intake end of 4 cards
	17.2	6.4	—	Outlet end of 4 cards
3 Good middling cotton	13.8	14.7	—	Intake end of 4 cards
	5.8	10.5	6.6	Outlet end of 4 cards

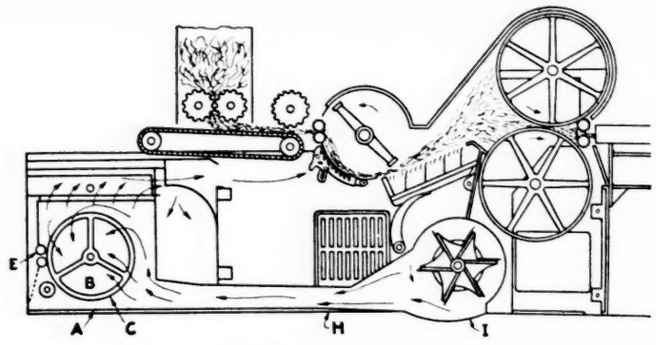


Fig. 7. Standard beater section of picker equipped with suction fan and a return air condenser. *A* indicates steel housing; *B* bearings for the return air condenser *C*; fluted rools for removing the waste lap are shown at *E*. Steel flue *H* of picker width and 5 in. deep connects the picker fan *I* exhaust with inlet of the filter housing. Picker fan removes about 1,000 to 1,200 cfm. This and Figs. 9, 10 and 11 are by courtesy of Saco-Lowell Shops.

from 200 to 400 cfm through the inlet side of the breaker.

The inlet opening to the breaker is quite large in area (3 x 5 ft) and this air volume would only provide an inlet velocity of 13 to 26 fpm. The inlet opening is restricted, however, by means of a canvas drop curtain which is displaced as the cotton bale moves forward. Actual measurements show the velocity to be from 50 to 100 fpm at the inlet to these openers. The increased velocity is due to the obstruction created by the canvas drop curtain.

The latest model bale breaker manufactured by the same company is ventilated in a similar manner to that shown at the top of Fig. 4. This device is called a cleaning and blending feeder, but uses principles similar to the bale breaker. This equipment is ventilated by a No. 00 Sturtevant Monogram Fan. A metal panel with a hinged metal door at the bottom restricts the air inlet to about 1 sq ft area. The air velocity measured at this opening varies from 100 to 175 fpm. This latter machine is more efficient than the opener shown at the top of Fig. 4 which permits the air concentrations shown in Table 2 for No. 1 ventilated bale breaker. The lower velocity in this case apparently is not adequate to remove all the dust and lint. *In our opinion, air contamination in opening and picking should be maintained below 5 mgs per cubic meter to eliminate complaints and nuisance problems.*

The second method of ventilation observed on bale breakers is that shown in the lower part of Fig. 4. Here the opening of the breaker is restricted by the hood to approximately one-half of the total area. The air volume exhausted through the hood is approximately 1,200 cfm. This produces a velocity inward below the hood which varies from 25 to 125 fpm (mean 70) over the open area. Some of the air exhausted from the breaker is taken by the conveying duct shown at the right. Unfortunately this air is contaminated with dust and lint which is carried along to the picking operation. Some of it may be removed by the textile condenser; the remainder is retained by the cotton to be removed later.

In other openers, the discharged cotton from the bale breaker falls on a conveying belt which feeds the cotton from several machines to a common hopper. From this hopper it is pneumatically conveyed to the pickers. At this discharge point there is also air movement inward to the bale breaker which is created by the fan type shown in Fig. 4. This serves to remove the dust and lint at the discharge point. The hooded type in Fig. 4 has a canvas curtain which also restricts the inlet area. but is located beyond the hood so that no air is drawn from the rear discharge point.

Picking Room Ventilation

Pickers in the mills we have visited utilize ventilation which is integral in the machine design. It is not ventilation designed to reduce air contamination, but rather to serve as an adjunct to cleaning the cotton. Fig. 5 shows a breaker-picker, and Fig. 6 an intermediate-picker. A finisher-picker is the same in operation as the intermediate-picker. Fig. 7 illustrates a beater section of a picker.

It can be noted in these figures that paddle-wheel fans are incorporated as an integral part of the machine design. The purpose of these fans is to draw off the dust, trash and lint as it is freed from the cotton by the beating action and the sucking action of the fans. These fans move about 1,000 to 1,200 cfm per fan.

Integral in these machines is a revolving perforated screen, the inside of which is exhausted directly by the fans. These screens prevent most cotton fibers from passing through, but the holes are large enough to permit dust, short fibers and leaf fragments to pass. This screen principle is the basic feature of the textile condenser and the return air condenser which will be discussed later. A return air condenser is shown as an integral part of the picker in Fig. 7.

This device consists also of a revolving screen with finer holes. This screen rotates at a much slower rate (approximately once per 1½ hours) than the picker screens or the ordinary textile condenser. At this slow rotation a lap of cotton fibers builds up and forms a filter mat which removes some of the dust and fine lint which is passing through it. Until this lap is built up, however, a considerable amount of contaminants escape. This escaping material results in contamination of the picking room air. No attempts have been

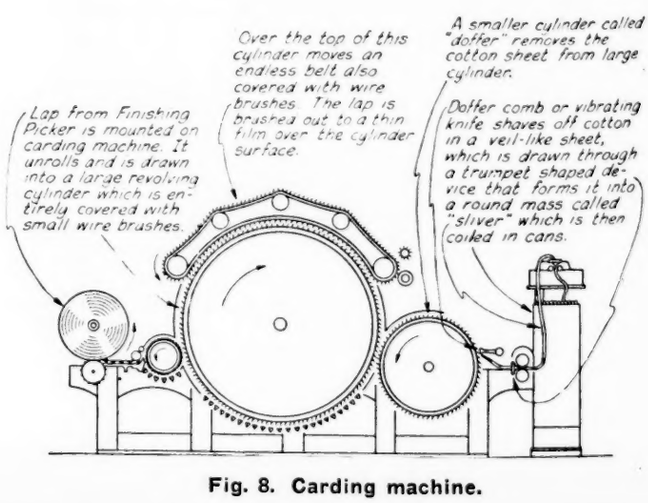

Lap from Finishing Picker is mounted on carding machine. It unrolls and is drawn into a large revolving cylinder which is entirely covered with small wire brushes.
Over the top of this cylinder moves an endless belt also covered with wire brushes. The lap is brushed out to a thin film over the cylinder surface.
A smaller cylinder called "doffer" removes the cotton sheet from large cylinder.
Doffer comb or vibrating knife shaves off cotton in a veil-like sheet, which is drawn through a trumpet shaped device that forms it into a round mass called "sliver" which is then coiled in cans.

Fig. 8. Carding machine.

made to ventilate pickers other than the method described and it is believed that no such ventilation is necessary (since all the cleaning operations are enclosed) if the contaminated air drawn from the picker fans is discharged from the room or thoroughly cleaned before its return to room air.

Carding Room Ventilation

Ventilation of carding engines in this country is an exception rather than a rule. The concentrations shown in Table 4 indicate that ventilation of this operation would be desirable. A typical carding machine is detailed in Fig. 8. The points where dust and lint arise are at the brushing operation, the doffer, the doffer comb, and the points where the sliver passes through restricted openings. The greatest dissemination appears to be at the doffer comb or vibrating knife for removing the cotton from the doffer.

A larger amount of contamination was present when the cards were cleaned or stripped by blowing, but now vacuum strippers are employed for this purpose. These strippers are simply small hoods connected by flexible hoses to a blast gate and a galvanized iron duct branch system. These hoods are moved across the doffer and suck off the fine particles during the stripping operation. The flexible hose connects to a branch of an exhaust duct which discharges out of the card room to the dust house.

An alternate device uses a fixed hood covering the doffer with a small slot opening through which the air enters when the blast gate is opened. Each card is equipped with such a stripping device, but the exhaust is only used for stripping. Since only a few cards are stripped at a time, the fan capacity provided is small. Enclosure of cards for ventilation has been reported in England and in a few mills in this country. In England, hooded cards have been used in waste spinning operations. Originally, the operation was only enclosed, which reduced the dust concentrations, but now these hoods are also exhausted, which eliminates practically all of the dust. Dust in waste spinning is less than in yarn mills because of wider card spacing, and since cotton used has been previously cleaned in the spinning mills. The material has also been soaped, which causes the dust to adhere to the fibers. This does indicate, however, that cards can be enclosed and the dust problem eliminated by exhausting the enclosure.

Because of the larger floor area in carding, as in picking, it is necessary that some efficient means of air cleaning be employed so that exhausted air can be recirculated and make the installation of local ventilation economically feasible.

Several methods of air cleaning are used in textile mills. These are air washing, primarily installed for air conditioning, settling, centrifugal separation, filtration, and electrostatic precipitation. Air washing is not efficient for removing fine particles of dust and lint and use of such devices for air cleaning and recirculation of the air to the workroom is not desirable. Settling chambers are used as a method of collecting the exhausted dust and are not installed for recirculation. Obviously they can only remove coarse

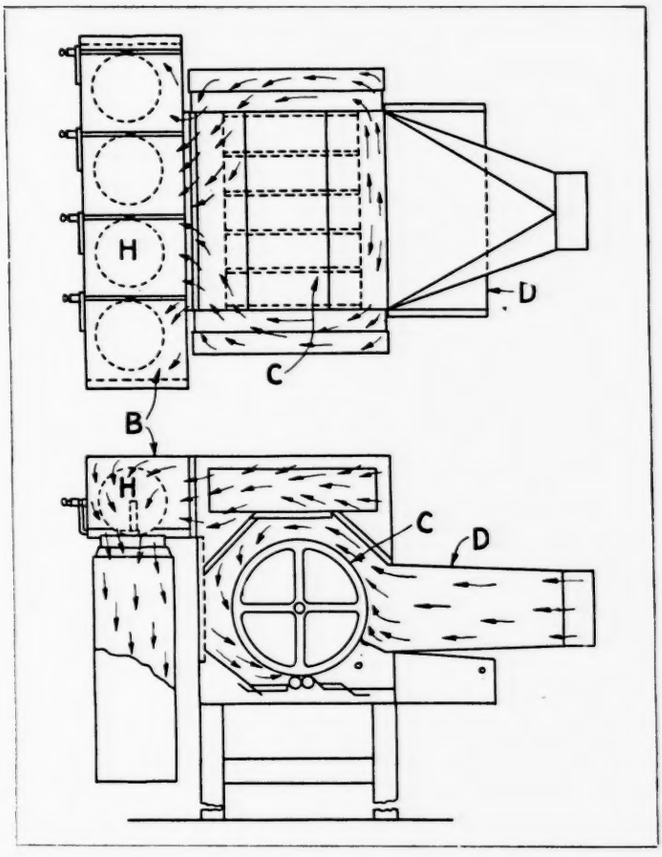


Fig. 9. Schematic diagram of return air condenser equipped with filter bags for cleaning air. Air from duct D filters through return air condenser C which then passes through bag housing B and bags H.

materials. The most common settling device is the dust house, which is a large chamber sometimes with floor dimensions as large as 50 by 50 ft or greater, and three or four stories high. The dirty air is blown into this chamber directly and exhausted at the top, or the air is blown to a cyclone collector which surmounts the dust house. The latter then acts as a dust bin for the cyclone.

Centrifugal separation or the use of cyclones is only practical for collection of dust greater than 10 to 25μ and it is obviously not feasible to recirculate this air. In fact, it is not desirable in some instances to discharge this air to the atmosphere without giving it some height by means of a stack or high location to prevent pollution of the area around the collector.

The last two methods, namely, filtration and electrostatic precipitation, appear to be the most applicable to recirculation in opening, picking and carding operations. The history of filtration in the cotton textile industry is unique. Since pneumatic conveying is widely employed for material handling a device was necessary to separate the air from the cotton. This device is known as the textile condenser and consists of a revolving (300-400 rpm) perforated drum with air exhausted from the center of the drum. The exhausted air is discharged from the room or recirculated through an efficient air cleaning device. The textile condenser does serve as an air and material cleaner, but is not a very effective one. Studies on material samples for three such condensers show an

average removal of 17.3% organic trash and 21.8% dust from the cotton entering the condenser.

The idea of incorporating the condenser principle into a filter was next evolved, and the result was the return air condenser. This device has been briefly mentioned and is shown in Fig. 7. In this device the speed of the revolving perforated screen is reduced to one turn per 1½ hours. The screen perforations are decreased to approximately 80 mesh. At the slow rotational speed a lap of cotton lint approximately ½ in. thick is built up on the drum through which the exhausted air pauses before being discharged to the room. The filtering velocity through this lap is approximately 1,000 fpm.

Efficiency for the return air condenser for removal of total dust is low. Preliminary measurements indicate it is not greater than 50 per cent. Analysis of these samples shows that the percentage dust concentration leaving the filter is almost twice that on the upstream side. The organic trash percentage concentration may be as much as 50% greater. This indicates that the return air condenser does not remove the finer particles of organic trash and dust. This was realized after a few years of field application of this device. In order to correct this the discharged air from the return air condenser is passed through filter bags as shown in Fig. 9 and 10. A large bag installation of this type for a large opening room is shown in Fig. 11. The filtering velocity (approximately 150-300 fpm) through these bags is much higher than velocities for cloth filters used in dust collectors which rarely exceed 10 fpm.

In spite of this high velocity, the total weight efficiency of the bags as shown in preliminary tests is

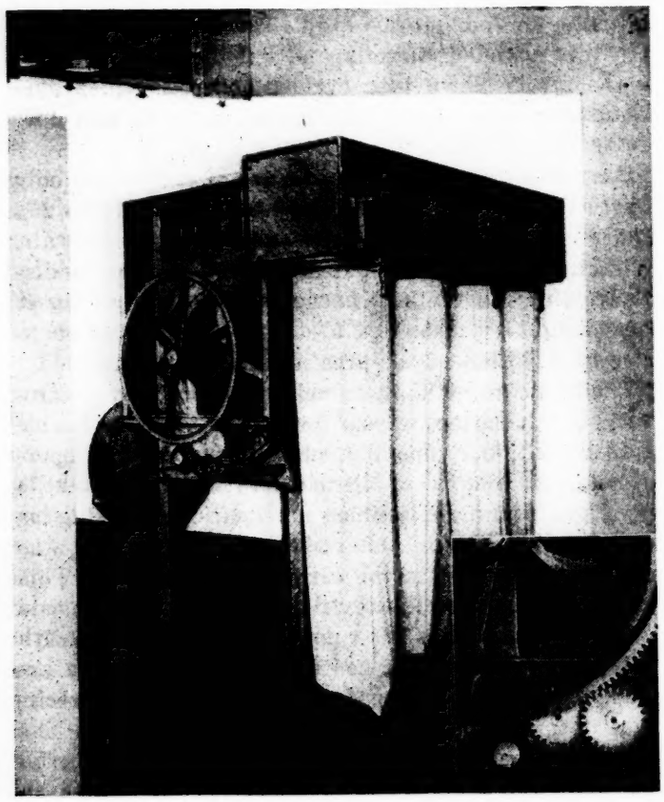


Fig. 10. Return air condenser and bags.

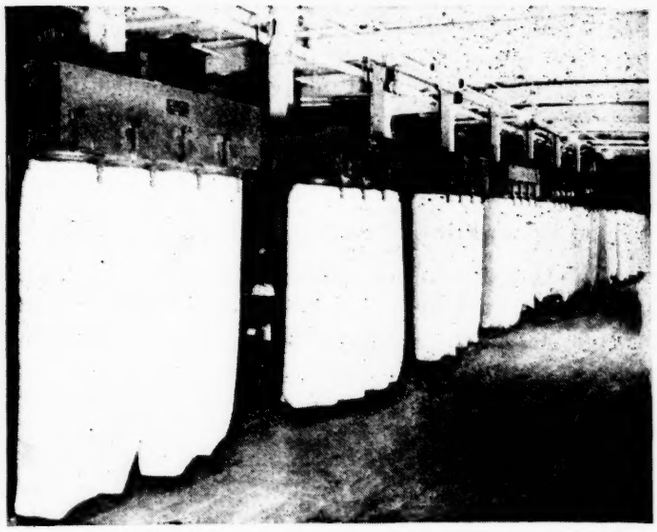


Fig. 11. Series of return air condensers and bags as installed for air recirculation in a large opening and picking room.

99.5%; lint efficiency was 98.7%. Counts taken on this discharged air with the Bausch and Lomb dust counter, which is more selective for fine particles than the impinger, shows counts of 9.3 to 12.2 million particles per cubic foot. The number of fibers ranged from 0.2 to 0.6 million particles per cubic foot of air. The general room air corresponding to these samples varied from 4.9 to 8.2 million particles per cubic foot. These data indicate that bag filters on return air condensers do an effective job of air cleaning for opening and picking rooms. No such installations have been observed in card rooms.

The use of electrostatic precipitators in cotton textile process air cleaning has not been observed, but some installations have been reported in this country and England. In this country their use is restricted to cleaning supplied air to the mill, whereas attempts are being made in England to use them for cleaning card room air. The efficiency is claimed to be 100%, especially for fine particles. It is our opinion that for this device to be effective in opening, picking or carding rooms, it should be preceded by some device such as the return air condenser to remove the bulk of the lint and trash. This equipment would reduce the cleaning frequency and maintenance of the precipitator.

Summary

A study is now in progress at the School of Public Health to determine atmospheric concentrations of air contaminants in cotton textile mills; ventilation requirements for cotton textile processes; and improved methods of controlling dust and air-borne lint. Dust and lint control is desirable in cotton manufacturing processes to improve the appearance of workrooms and the products; nuisance contamination is of greater significance than any health hazards.

The data in this paper give a comparison between cotton mills handling different grades of raw cotton with various types of cleaning equipment. These data were obtained with new types of sampling equipment which are briefly described.

Cooling Banbury Mixers and Rubber Mills

J. PARTINGTON, Jr.
Air Conditioning Department, General Electric Co.

Considerable heat, which must be carried off by cooling water, is produced in Banbury mixtures used in the manufacture of rubber. Article discusses how to calculate cooling water and refrigeration required by mixers and rubber mills.

UNCONTROLLED heat plays havoc with rubber. The tires on racing cars give out not from wear but because of the extreme heat generated by fast driving and skids on turns. Rubber to be useful for most commercial purposes must be vulcanized, but this heating process must be carefully controlled. Rubber to have wearing qualities must be compounded with other ingredients. The compounding or mixing process is carried out in Banbury mixers and on sheeting mills.

A Banbury mixer is used for the initial compounding of the mixture of crude rubber, reclaimed rubber, the carbon black and the other ingredients which go to make up the desired types of rubber. We are not vitally interested in the particular mixture of ingredients that go into the Banbury but in what happens inside it. The Banbury functions almost like a baker mixing bread. It has two tear drop shaped rotors, set approximately at right angles to one another, which impart a kneading action to the rubber components. The mixing process takes place in the dry state and the ingredients are in solid form, hence they resist the action taking place on them and heat is produced. This heat must be controlled to prevent scorching and resultant damage to the mixture.

To remove the excess heat, the rotors are cored out for the circulation of cooling water. The inside walls of the Banbury cooling jacket are also sprayed on with cooling water for the same purpose. If city water is low enough in temperature, it is used for cooling. When city water gets too warm in the summertime, when the water cost is too expensive, or where the water source is undesirable because of its chemical content, refrigerated water is the logical solution to the problem of accurate temperature control. There is no application problem involved other than determining the load since the Banbury is already designed for water cooling.

The maximum permissible city water temperature will vary quite widely depending upon the end use of the rubber and upon whether it is natural or synthetic rubber. Synthetic rubber usually must be kept cooler during compounding than the natural product. The latter can be mixed satisfactorily for certain purposes until the cooling water temperature reaches about 80F although the gallonage required increases greatly and uneconomically. However, the manufacturers of overshoes, for example, feel that they obtain the best results when 45F to 50F cooling water is used. Such temperatures, naturally, rule out city water cooling during the summer months in most parts of the United States and make refrigeration a production must.

Banbury mixers are manufactured in several sizes ranging from laboratory sizes to 800 hp (single and multi-speed). Their approximate capacity in rubber stock pounds per batch using 1.5 specific gravity stock will run from ¾ lb to 850-1000 lb.

The cooling load can be estimated quite accurately from the power requirements of the Banbury mixer.

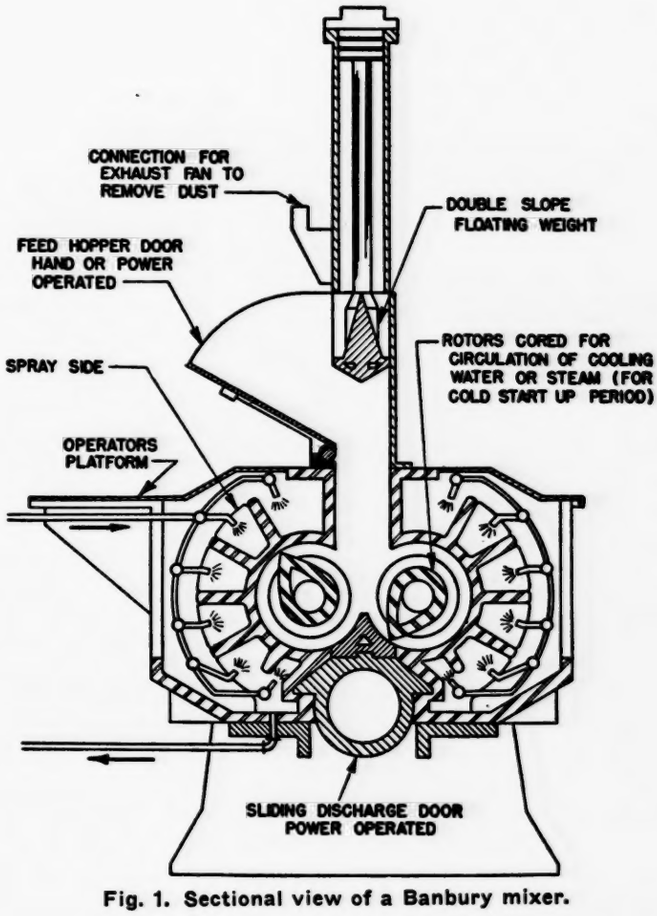

CONNECTION FOR EXHAUST FAN TO REMOVE DUST
DOUBLE SLOPE FLOATING WEIGHT
FEED HOPPER DOOR HAND OR POWER OPERATED
ROTORS CORED FOR CIRCULATION OF COOLING WATER OR STEAM (FOR COLD START UP PERIOD)
SPRAY SIDE
OPERATORS PLATFORM
SLIDING DISCHARGE DOOR POWER OPERATED

Fig. 1. Sectional view of a Banbury mixer.

Generally the motor drive is somewhat larger than required from an R.M.S. (Root Mean Square) heating standpoint because the mixing is done in batches with some time between batches during which time the motor is running at very light load. Because of this a load factor of 70% can be safely assumed. Furthermore, the total output of the motor does not contribute to the cooling load. Some of the heat in the batch is dissipated to the air surrounding the Banbury mixer. Gear losses account for some of the motor output. Approximately 75% of the motor output actually contributes to the cooling load. The total cooling load then becomes: Motor hp $\times$ load factor $\times$ per cent contribution to cooling load.

Cooling Load $=$ 0.70 $\times$ 0.75 $\times$ motor hp
Cooling Load $=$ 0.525 motor hp
1 hp $=$ 2546 Btu per hr
Cooling Load $=$ 0.525 motor hp $\times$ 2546 Btu per hr
Cooling Load $=$ motor hp $\times$ 1340 Btu per hr

To change these to more usable terms, using a 10F rise in cooling water temperature, which is about the maximum temperature rise recommended by chiller manufacturers, and solving for gallons per minute per horsepower, we have

$$1340 = \text{gpm} \times 60 \times 8.33 \times 10$$
(Btu per hp per hr) (minutes) (lb per gal) (temp. rise)
$$\text{gpm per hp} = 0.268$$

For example, a Banbury mixer requiring a 250 hp motor would require 250 $\times$ 0.268 $=$ 67 gpm of cooling water based on a 10F rise. While a 10F temperature rise is good practice with chilled water, the recommended approximate minimum cooling water rate on city water for the above example is given as 100 gpm by the Banbury manufacturer. In summer this flow would probably need to be increased to at least twice that figure for city water and even more for pond water.

After processing in the Banbury mixer, the rubber stock goes either through a pelletizer or is dropped onto a mill for sheeting. The mill is composed of two cylindrical metal drums rotating toward one another on parallel axes with approximately a ¼ in. gap between the drums. One of the drums or rolls is geared to run slightly faster than the other so that the stock receives a kneading action in addition to the wringer effect. The mixed stock is taken off as a continuous strip approximately ¼ in. thick and 18 to 20 in. wide, cooled and stored or processed further.

Mills are usually designated by the width of the rolls. Sheeting mills require the following approximate minimum gallons of city water per minute:

60 in. mill — 75 hp — 30 gpm
84 in. mill — 100 hp — 45 gpm

Mills are often used to mix highly sensitive stocks with curatives and accelerators, as well as color. To prevent scorching the stock, the mill rolls usually require cooling. Water is sometimes sprayed on the inside periphery of the cylindrical rolls by means of a "piccolo" or pipe in which many small holes have been drilled. The opening at one end of the cylinder

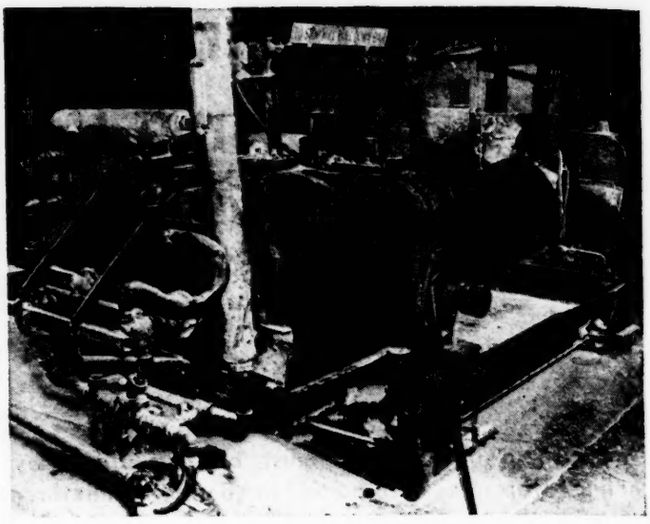


Fig. 2. A 60-in. rubber mill showing flexible cooling water hose connection.

is made smaller in diameter than the rest of the cylinder and forms a dam for the water which collects in the bottom of the cylinder. The overflow water is collected at the low point in the dam in a funnel and pumped back through the water cooler (in the case of refrigerated water) or allowed to go to waste. The spray method is superior to flooding the bottom of the drum as more heat transfer is accomplished and uniform cooling is obtained.

The following table gives typical horsepower of the driving motors and the cooling water requirements for various sizes of individually motored mixing mills:

36 in. mill — 50 hp — 20 gpm
48 in. mill — 75 hp — 25 gpm
60 in. mill — 125 hp — 40 gpm
84 in. mill — 200 hp — 60 gpm

These cooling water requirements are for city water and can be reduced somewhat for refrigerated water by using the formula given above for Banbury cooling.

It is easy to recognize the need for cooling when you stand in front of a mill, see the way the stock is tortured, and hear the way the rubber snaps like a giant popping his bubble gum with pistol-like reports.

Tubers, or extruders also require cooling during part of the cycle. Motor horsepower requirements vary widely depending on the product. The same general method of calculating cooling load can be used as for the Banbury provided the proper load factor is applied.

Calenders are also used in the processing of rubber. A typical 3-roll calender will require approximately 50 gpm for drum cooling.

Plasticators also require some cooling. A typical 500 hp unit requires approximately 35 gpm.

Having determined the load and translated it into Btu per hr, the next step is to find how much cooling is required. The following tables will indicate the refrigeration horsepower requirements for both water cooled condensers and evaporatively cooled condensers when applied to refrigerated water cooling systems:

Table 1 — Refrigeration HP Requirements for Water Cooled Condensers

Water cooled from 55 to 45F.
Condenser water inlet temp. 75F.

Recirculated Water Cooled, GPM	Cooling Load		Refrigeration HP Required	Approximate Condenser Water Consumption, GPM
	Btu per hr	Tons		
10	50,000	4.17	5	4
20	100,000	8.34	10	13
30	150,000	12.50	15	13
50	250,000	20.80	25	31
60	300,000	25.00	30	25
90	450,000	37.50	40	51
110	550,000	45.80	50	63
125	625,000	52.10	60	75

Table 2 — Refrigeration HP Requirements for Evaporatively Cooled Condensers

Water cooled from 55 to 45F. Outdoor wet bulb —75F.

Recirculated Water Cooled, GPM	Cooling Load		Refrigeration HP Required	Approximate Condenser Water Consumption, GPM
	Btu per hr	Tons		
10	50,000	4.17	5.75	0.25
20	100,000	8.34	10.75	0.50
30	150,000	12.50	16.00	0.75
50	250,000	20.80	26.75	1.00
60	300,000	25.00	32.25	1.25
90	450,000	37.50	48.00	2.00
110	550,000	45.80	58.00	2.50
125	625,000	52.10	68.00	3.00

Table 2 includes the evaporative condenser fan and pump load under the column headed, "Refrigeration HP Required."

When water is scarce, as it is fast becoming for most industrial plants, or where it is expensive (over $1 per 1,000 cu ft) consideration should be given to the use of evaporatively cooled condensers.

The following problem will illustrate how to use the above data in determining the refrigeration requirements for a typical installation of rubber milling equipment:

Fig. 3. Tuber used to apply rubber insulation to electrical wire, coated wire enters pipe at extreme right where it is cured with steam and then cooled with refrigerated water.

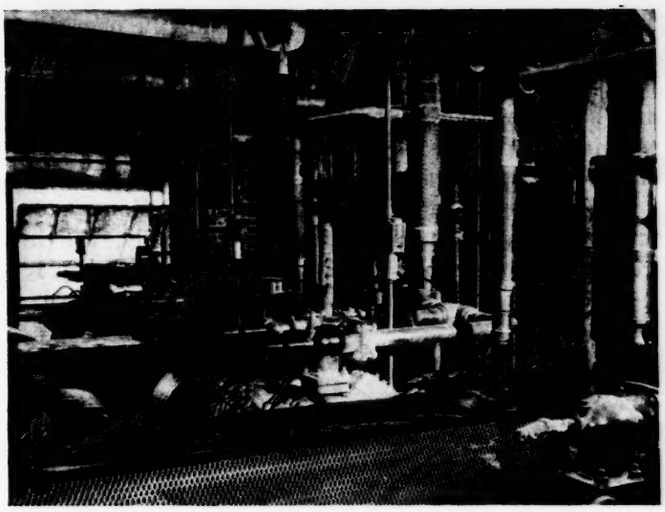


Fig. 4. Four 50-hp compressors in foreground connect to evaporative condensers used to generate chilled water for battery of rubber mill rolls and tubers.

The survey disclosed the following equipment in use:

1—Banbury	200 hp
1—3-roll Calender	150 hp
3—60 in. Mills	250 hp
1—No. 1 Tuber	5 hp
2—No. 2 Tubers @ 15 hp	30 hp
1—No. 4 Tuber	25 hp
	600 Total hp

In this case, all three 60-in. mills were powered by a single 250-hp motor. Since a 60-in. mill requires 75 hp when individually driven, it would be correct to use 225 hp for the cooling calculations. The 250-hp motor would only have a 225-hp load on it and hence only produce that quantity of work on the rolls. Actually all machines will never be fully loaded simultaneously. Some factor, say 50 to 80%, should be satisfactory.

The corrected total load then becomes 635 hp. The total refrigerated water requirement based on a load factor of 70% and a contribution to cooling load factor of 75% = corrected total hp × 0.268 gpm per hp.

$$\text{Total gpm} = 635 \times 0.268$$
$$\text{Total gpm} = 170$$

If the load factor is other than 70%, this should be taken into consideration. From Table 1, two 40 hp systems will meet this requirement with some margin.

In the above example, cooling water cost $1.20 a thousand cubic feet, so consideration was given to the use of evaporative condensers for the refrigeration system. Two 90 gpm refrigeration systems with water cooled condensers would require a total of 102 gpm of cooling water as against 4 gpm for evaporative condensers, or an increased water usage of 98 gpm.

98 gpm × 60 min. × 8 hr. = 6288 cu ft per day

7.48 gals per cu ft

6.288 × $1.20 per M cu ft = $7.55 per day

Subtracting an increased power usage of 16 hp or 16 hp × 8 hr × 1 cent per kwh = $1.28 per day,

we show a net saving of $6.27 per day in operating expense with evaporative condensers. Assuming one shift per day and 250 working days per year, the annual saving would be $1,567.50. However, most of the machinery operates 16 or 24 hr a day. On the basis of a 5-year amortization period, the owner could afford to spend up to $8,000 more for a refrigeration system employing evaporative condensers. Actually, the increased first cost for such a system over one employing water cooled condensers should not run more than approximately $5,000. The owner would thus show a $2,000 return on his increased investment over a period of 5 years or an annual return of approximately 8%. There should, therefore, be no question as to the owner's decision.

The cooling of Banbury mixers and rubber mills is paying dividends every day in the rubber working industry by reducing spoilage, reducing outage time and by improving the product. This is but one of many uses of industrial refrigeration in industry.

Bonnet Output Nomograph

G. S. MacLEOD
Research Engineer, Williamson Heater Company,
Cincinnati, Ohio

A method for quick determination of air density, air weight, and bonnet output of forced warm-air furnaces when using testing apparatus similar to that specified in Commercial Standard CS 109-44.

ENGINEERS who have been called upon to conduct rating or output tests of forced-air furnaces have either waited until the completion of the test to calculate the average output, or have used the curves in Commercial Standard CS109-44* or in the NWAHACA Tentative Code for Testing and Rating Oil-fired Fan-Furnace Combinations, to determine some of the instantaneous values.

In some of our testing work, we wished to evaluate the bonnet output for each set of observations. The use of an alignment chart or nomograph seemed to be the logical method of arriving at these values.

The accompanying nomograph is presented here in the hope that it may prove of value to others engaged in this type of testing work.

The formulas involved, the directions for their use, and an example are shown on the chart. Using reasonable care in locating points on the scales, bonnet output values can be determined within one per cent of the calculated values, and in a very short time. Only three positions of a straightedge are required for each output value.

It will be noted that the range of the scales has been extended beyond values ordinarily encountered in rating work. This was done to enable the use of the chart when the unit is operating outside of code limitations, and also to make the chart useful in other air-handling applications.

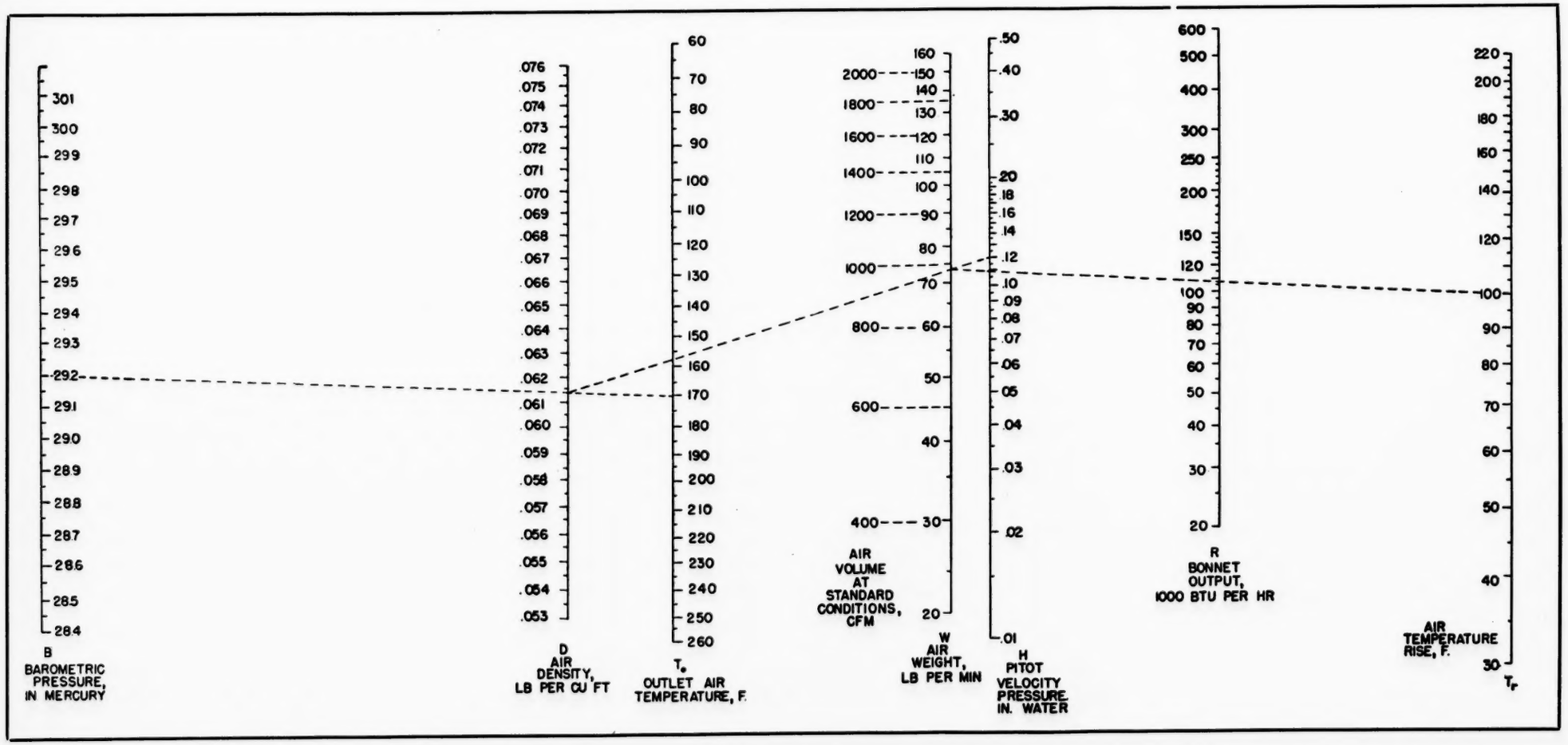
Since the air volume at standard conditions (cubic feet per minute) is equal to the observed weight of air handled (pounds per minute) divided by the density of standard air (0.075 lb per cu ft), correlative values of air volume are shown opposite the *W* scale.

The reader will probably find a number of uses for the chart in addition to the use for which it was designed. A few of the more obvious uses, with numerical examples comparing chart values and calculated values follow:

To find:	Establish a line between known values on scales:		Find wanted value where line crosses scale:	Chart Value	Calculated Value
(1) Air Density, lb per cu ft.....	B 29.92	T_o 68	D	0.075	0.0751
(2) Air Weight, lb per min	D 0.070	H 0.040	W	46	45.57
(3) Air Delivery at standard conditions, cfm....	D 0.0605	H 0.16	W	1,100	1,129
(4) Bonnet Output, 1,000 Btu per hr	W 90	T_r 100	R	130	129.6
(5) Required cfm at "standard"	R 100	T_r 90	W	1,015	1,028

Determination of air weight (Case 2) by means of the chart was a decided time-saver when some tests were being conducted to study the relationship between blower speed and air delivery under various conditions of static pressure and casing design in the development of a forced warm-air furnace. The furnace to be studied was placed under a 12-in. throat-diameter airflow meter as described in Commercial Standard CS109-44, and the observed values of the barometric pressure, outlet air temperature, and the Pitot velocity pressure when applied to the chart, quickly determined the corresponding air delivery in pounds per minute.

*"Solid-Fuel-Burning Forced-Air Furnaces" for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at ten cents per copy.



Nomograph for determining
D—air density
W—air weight
R—bonnet output of air flowing through a 12-in. dia flow meter as described in commercial standard No. CS109-44 when the following values are known:
B—barometric pressure
T_o—outlet air pressure
H—Pitot velocity pressure
T_r—air temperature rise through furnace

Procedure

Locate B and T_o values on their respective scales. A line between these points intersects the D scale at its value. Revolve a straightedge around the D value until it crosses the H scale at its value. Read the W value where the straightedge crosses the W scale. Using the W value and the known value of T_r on their respective scales, read the R value on the R scale where it is crossed by a line between W and T_r.

Example

Let B = 29.20; T_o = 170; H = 0.12; T_r = 100.

Following the dotted line on the chart, we find that D = 0.0614; W = 73.95; R = 106,500.

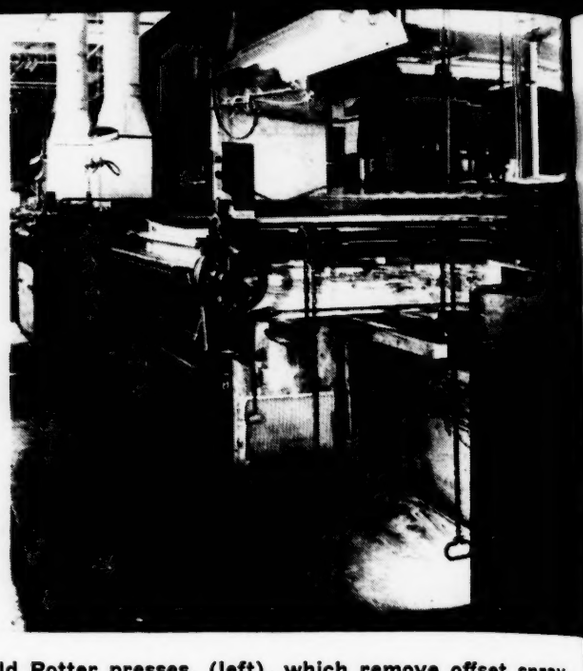
The values can also be found by the following formulas:

$$D = \frac{1.325 \times B}{460\ T_o}$$

$$W = 861.1\ \sqrt{D \times H}$$

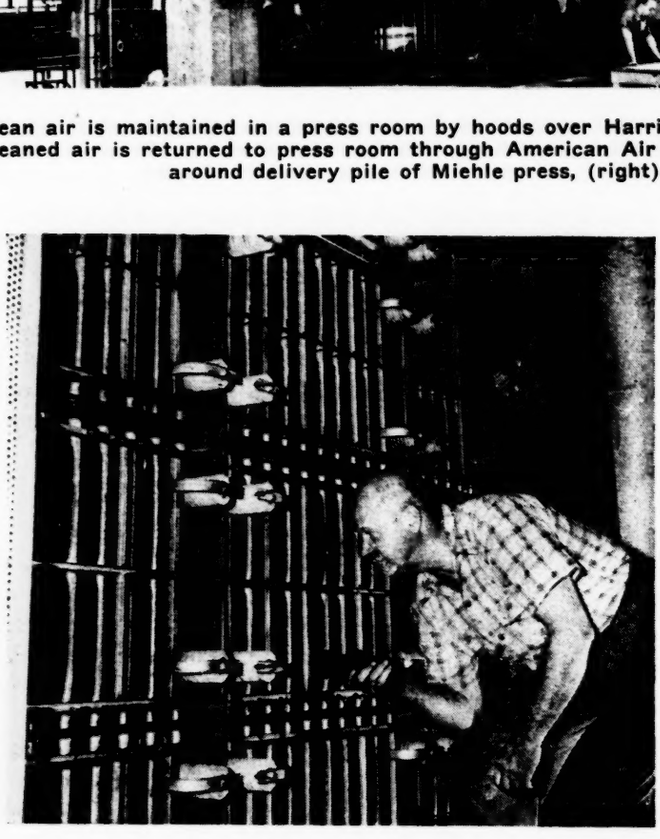
$$R = 14.4W \times T_r$$

Note: If the 9 in. dia throat flow meter is used, multiply the R value obtained from this chart by 0.5625 to obtain the correct value.

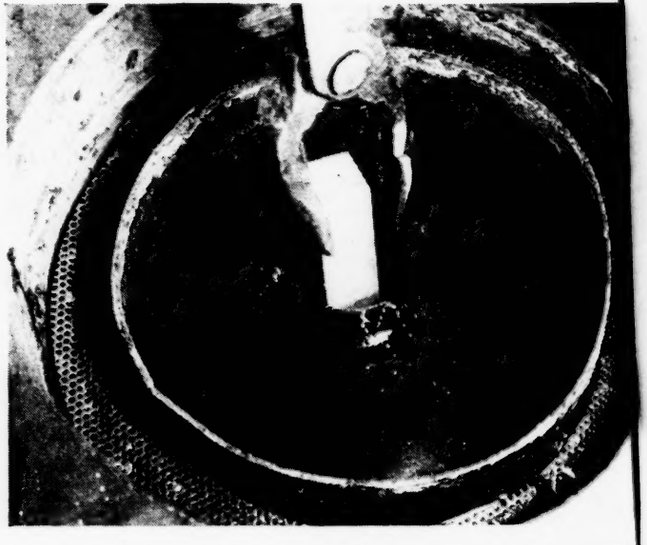


Clean air is maintained in a press room by hoods over Harris Seybold Potter presses, (left), which remove offset spray. Cleaned air is returned to press room through American Air Filter Roto-Clone. Floor-level exhaust grille and enclosure around delivery pile of Miehle press, (right), provide downdraft control of offset spray.

Picture Paragraphs



Howard Post, chief engineer of Madison Square Garden, examines the ionizer of a Raytheon precipitator, two power packs for which were installed in each of eight air handling systems which make up the new air conditioning system at the Garden (H&V:8:47:p114).



(Above) Experimental quenching operation at U. S. Steel punches a hole in water. Hole is really filled with invisible water vapor and lasts only long enough to be caught by .0001-second camera exposure.

(Left) Arctic and tropic weather maker creates temperatures ranging from —75F to 200F and pressures from sea level to 80,000 ft. Chamber is used by Westinghouse to test aircraft, electrical, and electronic equipment under severe operating conditions.

Cost of Delivering Compressed Air

A tabular computation method for estimating the cost of delivering compressed air is presented through the courtesy of the Compressed Air and Gas Institute.

THE cost of compressing and delivering free air using various forms of fuel is presented in tabular form for ready reference. This information is taken from chapter 5 of the new Compressed Air Handbook published by the Compressed Air and Gas Institute, and is presented through the courtesy of the institute.

Before interpreting the cost figures it is well to remember that free air is defined as air at atmospheric conditions at any specific location. Because the altitude, barometer and temperature readings may vary at different locations and at different times, it is apparent that the term does not mean air under identical or standard conditions.

While the cost of compressing air involves such factors as operating cost, power, labor, lubrication, repair, depreciation and interest on the investment, the tables only cover that item of cost represented by the cost of the necessary fuel to deliver a unit amount of free air.

Steam Engine Drive

To determine the coal cost of a steam driven compressor, first determine the steam consumption of the engine as closely as possible and the indicated horsepower required to deliver 100 cu ft of free air at the discharge pressure used. Table 1 will then give the cost of coal at $1 per ton to compress this air. Next multiply by the cost of coal. Table 1 is based on an evaporation rate of 7 lbs of water for each pound of coal burned under the boiler. If the evaporation rate is different, multiply the cost previously obtained by 7 and divide by the actual rate.

Table 1—Cost of Coal at One Dollar Per Ton to Compress and Deliver 100 Cu Ft of Free Air

(Multiply Figures in Table By Price of Coal in Dollars Per Ton)

Ton = 2,000 lb

Ihp. to Deliver 100 Cu Ft. Free Air per Minute	Pounds of Steam per Indicated Horsepower Hour Required by the Engine									
	24	26	28	30	32	34	36	38	40	42
16	.0457	.0495	.0533	.0572	.0610	.0634	.0680	.0724	.0762	.0800
18	.0514	.0557	.0600	.0643	.0686	.0714	.0772	.0814	.0857	.0900
20	.0570	.0619	.0667	.0714	.0762	.0793	.0857	.0904	.0952	.1000
22	.0627	.0681	.0733	.0785	.0838	.0872	.0943	.0995	.1047	.1100
24	.0684	.0743	.0800	.0857	.0914	.0951	.1029	.1085	.1142	.1200
26	.0741	.0805	.0866	.0929	.0990	.1030	.1114	.1175	.1238	.1300
28	.0798	.0867	.0933	.1000	.1066	.1109	.1200	.1266	.1334	.1400
30	.0855	.0929	.1000	.1071	.1142	.1189	.1285	.1357	.1429	.1500

Example: If it requires 22 indicated horsepower to deliver 100 cu ft at 90 lb pressure and the compressor is driven by a steam engine requiring 26 lb steam per hp hr, what is the coal cost?

Table 1 gives a figure of 0.0681 cents, which is the cost with coal at $1 per ton. If coal costs $4 per ton, our figure becomes $0.0681 \times 4 = .2724$ cents. This is the fuel cost for compressing 100 cu ft if the evaporation rate of a boiler is 7 lb of water per pound of coal. If the evaporation rate were 8 lb, the cost would be $0.2724 \times \frac{7}{8} = .2383$ cents.

The complete cost of the steam includes, besides the fuel cost, other items such as interest, upkeep, labor and depreciation. These items must be properly apportioned to obtain the true cost of the steam used.

Oil Engine Drive

The oil cost per 100 cu ft of free air is read directly from Table 2.

Example: If it requires 22 brake horsepower to deliver 100 cu ft of free air at 90 pounds pressure and the fuel oil costs 6 cents per gallon, the fuel oil cost per 100 cu ft of free air is 0.138 cents.

Table 2—Cost of Fuel Oil in Cents to Compress 100 Cu Ft of Free Air

Oil Consumption One-Half Pint (About .45 Lb.) Per Brake Horsepower Hour

Brake Hp to Deliver 100 Cu Ft of Free Air per Minute	Price of Fuel Oil, Cents per Gallon Based on Fuel Oil Value of 18,500 Btu, per Lb							
	3	4	5	6	7	8	9	10
16	.050	.067	.083	.100	.117	.133	.150	.167
18	.056	.075	.094	.113	.131	.150	.169	.189
20	.063	.083	.104	.125	.146	.167	.188	.210
22	.069	.092	.115	.138	.160	.183	.206	.230
24	.075	.100	.125	.150	.175	.200	.225	.251
26	.081	.109	.136	.163	.190	.217	.244	.272
28	.088	.117	.146	.175	.204	.233	.262	.293
30	.094	.125	.156	.188	.219	.250	.281	.314

Gasoline Engine Drive

Table 3 is based on a gasoline consumption of one pint per brake horsepower hour. This consumption will not vary greatly, but where there is a variation, the figures given in Table 3 should be changed in proportion to the variation. The cost is read directly from this table. If cost of gasoline is 16 cents per gallon, multiply the figures in the 8 cents column by 2.

Example: If it requires 22 brake horsepower to deliver 100 cubic feet of free air at 90 pounds pressure and gasoline is 16 cents per gallon, the gasoline cost per 100 cubic feet of free air will be $.367 \times 2 = .734$ cents.

Table 3 — Cost of Gasoline in Cents to Compress and Deliver 100 Cu Ft of Free Air

Gasoline Consumption One Pint (About .75 Lb.) Per Brake Horsepower Hour.

Brake Hp to Deliver 100 Cu Ft of Free Air per Minute	Price of Gasoline, Cents per Gallon							
	8	9	10	11	12	13	14	15
16	.267	.300	.333	.367	.400	.433	.467	.500
18	.300	.338	.375	.413	.450	.488	.525	.563
20	.333	.375	.416	.458	.500	.542	.584	.626
22	.367	.413	.458	.504	.550	.596	.642	.688
24	.400	.450	.500	.550	.600	.650	.700	.750
26	.433	.488	.542	.596	.650	.705	.759	.813
28	.467	.525	.584	.642	.700	.759	.816	.875
30	.500	.563	.626	.688	.750	.813	.875	.938

Table 4 — Cost of Gas in Cents to Compress and Deliver 100 Cu Ft of Free Air

Based on Fuel Consumption of 10,000 Btu Per Bhp Hr

Brake Hp to Deliver 100 Cu Ft of Free Air per Minute	Gas Rate Based on 1000 Btu Gas Cost of Gas in Cents per Thousand Cu Ft							
	10	15	20	25	30	35	40	45
16	.026	.039	.052	.065	.078	.091	.104	.117
18	.029	.044	.059	.073	.088	.102	.117	.132
20	.033	.049	.065	.081	.098	.114	.130	.146
22	.036	.054	.072	.090	.107	.125	.143	.161
24	.039	.058	.078	.097	.117	.136	.156	.176
26	.042	.063	.085	.106	.127	.148	.169	.190
28	.045	.068	.091	.114	.137	.159	.182	.205
30	.049	.073	.098	.122	.146	.170	.195	.220

Gas Engine Drive

Table 4 is based on gas having a heating value of 1,000 Btu per cu ft. If the gas has a different heat content, change figures in table proportionately.

Example: If it requires 22 brake horsepower to deliver 100 cu ft of free air at 90 pounds pressure and gas cost 20 cents per thousand cu ft, it will cost 0.072 cents. If the Btu content of the gas were 700, the gas cost would be

$$.072 \times \frac{1000}{700} = 0.1029 \text{ cents.}$$

Air Conditioned University

Faced with fat enrollments and thin building prospects, school authorities are turning to air conditioning as one way to ease the burden of crowded classrooms and overtaxed facilities.

In the forefront of studies now being made is the record of the University of Omaha which, before the war, gained the distinction of becoming the world's first completely air conditioned university. Now overshadowing that distinction is what air conditioning has accomplished for the university since the war as enrollment has doubled and the year 'round school program has expanded in both size and scope. Combining winter heating and summer cooling throughout 1,750,000 cubic feet in 200 classrooms, here are some of the results as reported to the Refrigeration Equipment Manufacturers Association:

(1) Despite twice as many students, classroom facilities are employed to capacity with the air in each of the school's 200 rooms regulated according to the percentage of occupancy.

(2) Kitchens and laboratories are freed from objectionable air and therefore may be used longer and more frequently.

(3) Summer school enrollments have increased because of the comfort of the classrooms—the university's summer school has students from 40 other institutions.

(4) Teachers are easy to engage during the summer—usually only one call is necessary.

The university's air conditioning system provides controlled temperatures twelve months in every year —an advantage that is being viewed by educators in terms of either lengthening the school year or otherwise employing school facilities continuously and without the interruption of vacation periods. In addition to maintaining a temperature of 72F throughout the winter and 72 to 79F in the summer, depending on outside weather, the system washes and filters the air and controls humidity. These features are adaptable to the year 'round weather in Omaha, but school officials call attention to the value of the cooling features in Southern schools where cooling the air alone would provide unusual benefits.

Complete air conditioning at the University of Omaha was voted by the school's regents following consideration of an architect's plan for incorporating cooling equipment to operate in conjunction with already-installed heating facilities of the structure which consists of a center building four stories high and two wings of three stories each—actually, three buildings in one.

Cooling equipment consists of two wells for supplying water, of which about 135,000 gallons are used on an average Omaha summer day, mechanical refrigerators, and two storage reservoirs. Water pumped from the wells to a 1,000,000 gallon reservoir travels to the refrigerators, then to the cooling coils and condensers and finally to a second reservoir, from which it is circulated for cooling. Following use, the water is used for lawn sprinkling or diverted to sewers.

Experience is my Classroom

By T. W. REYNOLDS

TREES AND CHIMNEYS

I never go out on a chimney trouble job without looking for the tree, so often have I read of its evil effects. It is supposed to put a special blight on a fireplace chimney which isn't powerful enough to defend itself against the downdraft of a very high tree. What, then, could be more natural when my own fireplace began to smoke backward than to blame it on the high tree and promptly to cut that tree down,

The fireplace gradually devoured this tree, but continued to smoke, so I laid the books aside and began to reason. There are no leaves on a tree in the winter time, might be some left in the late fall when draft is not at its best; still the trunk of the tree might have some adverse effect. On the other hand the fireplace did not smoke when the fireplace was new and the tree was fully as high.

This line of reasoning led to an examination of the fireplace interior, and sure enough, there it was. Just a warped damper frame from too many too hot fires bowing it out to where the flame and smoke was deflected at right angles out the fireplace front. The tree was old and on its way out anyway, but the books shouldn't be so positive about such things.

FIREPLACE PHILOSOPHY

Near an open fire one does a lot of dreaming—and some thinking—interrupted only by an occasional poke at the fire. As the fire dies a new log is tossed on, the fire burns brightly for a moment, then settles down a bit. Why?

Because you settle things down to where the fire was hottest, made more contact, the bark has a lower ignition point, and the wood is dryer on the outside. In time the fire comes up better, because there is now a higher pile to give more draft.

Somewhat later you throw on another log, one of very large diameter, but it burns slowly. Split another log in half, yet similar in all respects, toss them in and the two halves burn up ahead of the unsplit log. Why?

Presumably because you have more surface exposed to the fire. The unsplit log may also be denser and more resistant near the center and with more of moisture at that point, furthermore its charred exterior no doubt acts as an insulator to heat penetration.

DRIP PAN INSULATION

Someone, somewhere, raised the question as to the necessity for insulation below a drip pan which receives the dew from a cooling coil in a comfort air conditioning installation. The writer investigated the question and found that opinions vary with the engineer. Just how can this slight amount of moisture (usually at a temperature above 60F) create any condensation on the bottom of the drip pan. The moisture doesn't stay around long enough to cool anything it contacts, but is quickly drained away. Insulation, however, is probably required on an industrial application where defrosting of the coil brings the condensation down to 32F.

The same kind of question sometimes arises in connection with a surge tank holding chilled or well water, say at 50F. Should its bottom be insulated? No, not if the bottom of the tank is grouted tight in cement and the tank rests on a floor laid on earth and there is no objection to sweating of the concrete immediately adjacent to the tank's perimeter. Yes, if the bottom of the tank is on an upper floor, since the concrete will be cooled, and yes if the tank rests on beams, as it usually does. The insulation would be 2-inch cork, the same as the balance of the tank. Such a thickness is good for a loading of 2500 lb per square foot.

BATHROOM TROUBLES

Means for quickly raising the temperature of air in a bathroom to 80F will not warm the tub and floor. One engineer overcomes this by connecting the bath room radiator to the domestic hot water circulation line, so that the radiator is always warm.

Well, that is one way, but I prefer the floor panel heating system in my own bathroom which was acquired by accident. The steamfitter ran the steam pipes through the line of least resistance directly in the flooring. The flooring has never cracked, and has always remained as a warm pleasure for bare feet to tread upon.

When you acquire a shower mixing valve, buy the best and you may get the worst. You don't want one (I know) of the type which is affected by unequal pressures between hot and cold water lines, the kind that goes out of kilter whenever the toilet is flushed, especially so with high pressures. If you want to change it for a cheaper one, the mechanical type, you will need the services of a tile setter as well as a steamfitter, for the mechanical type is of much larger diameter. If the mixer is not concealed, the change over is not so difficult to make.

Concealed mixers are nice, but being out of sight, are harder to work upon when built-in check valves deteriorate. When the valve ceases to function, hot water backs up in the cold water pipes even to the extent of warming the toilet bowel as it is flushed.

A visitor to the house was told not to use the shower for it gave out only cold water. His curiosity aroused, he did use the shower and reported it hot. I ran upstairs all out of breath and with great delight, only to discover that the water ran cold as soon as the backed up hot water in the cold water pipes had been fully withdrawn.

KEEPING A RADIATOR HOT

While trouble hunting at Weehawken years ago when in the employ of the West Shore Railroad, I found one radiator which sometimes was very hot, but once cold it just wouldn't get hot again, at least while one was around. Some occupant of the space would turn it off at night or at other times when the space was too warm.

A number of expensive changes were required to overcome this condition, so we simply had the interior working parts of the valve quietly removed one night, but left the wheel for anyone to operate to their heart's content.

The line to this radiator was long, without adequate covering or grade, and was run exposed at the ceiling of a wind-blown passage which was used for passenger traffic. Furthermore, a portion of the line had steam and condensate counterflowing within it. Its size could take care of normal steam and water flow, but when first heating up so much cold metal was too much for the steam pressure to overcome.

Note: Mr. Reynolds is Chief, Air Conditioning Division, Abbott, Merkt & Co., Engineers, New York.

TESTING CHIMNEYS FOR LEAKS

There is nothing like a smoke test for finding out where the leaks are in a flue or chimney. For this test there should first be a good fire in the boiler, so as to warm the chimney up and provide a good draft. After this is obtained, some oily rags or about a square yard of tar paper should be thrown on the fire or burned in the chimney base so as to produce a good volume of dense smoke.

After this is burning well and smoke appears at the chimney top, cover the chimney top with a piece of old carpet, wet newspaper, or old wet blankets. Weight down the coverings with boards and keep the refuse burning for five minutes. Smoke will then escape wherever leaks exist. The nature of the leakage will determine the extent of repairs necessary.

APPLICATION NOT A SCIENCE

The young college graduate has been taught an exact science. It is hard for him to substitute guess as altered by judgment, those things with which application is most concerned. So he must unlearn the former approach and get down to what at first looks to him as rather a haphazard way of doing engineering. For example, if you design an installation with one boiler or compressor as a spare, and you usually do, you know that load refinements are no longer so important. Any slight load that is missed could be handled by the spare for the short peak period it occurs. It may even be handled without the spare, since lowered efficiencies at overloads of short duration are of no moment, and finally not all loads are coincident.

The time taken by most exact computations may make you feel more comfortable, but the time spent is a needless expense, nor can any computation ever be made so exact that it will not be upset to some degree by field conditions.

Suppose the young engineer is figuring the air conditioning requirements for a particular space. A coffee urn is implied in the meager data before him. What size is the urn? Dependent upon size it could give off 3000 or 5000 Btu. He doesn't know what to do, his exact science is shot full of holes. He is adrift in a vast sea. His rudder is lost and so is he.

Applied science, however, if we may call it such, says what difference does it make which value is taken. It will make relatively but little difference in the total supply air requirements, unless the area served is very small. A compromise, or even the larger value can be taken. If there is too much air it can be dampered down; in any event, the final kitchen layout might show two urns instead of one.

Suppose the young engineer is out on a job to find out the boiler load. He comes across a very ancient type of radiator. What does he do, search for old catalogs or an old engineer for the rating of the radiator, or does he simply take a rough measurement of its surface as a close enough approximation for its heat output? There are too many variables and unknowns in application to consider the niceties of each problem.

CHIMNEY SIZING

For battery installations the area of the chimney is generally taken as two-thirds to three-quarters the sum of the areas required for the same number of single boilers. The height is increased from 5 to 15 ft above the single boiler chimney height in order to compensate for additional turns and damper leakage.

Chimneys for oil fired boilers can usually be taken 75% of height and area of chimney for the same output with solid fuel. In cases where a change may be made back to coal at some future time, the chimneys should be selected on the basis of solid fuel.

Chimneys on outside walls and especially exterior steel stacks lose heat from their surfaces and are apt to be sluggish under low load. Some compensation should be made for such conditions. A brick chimney with one side outdoors is quite apt to leak in time due to weathering at the joints of brick work.

BURNER ON, THEN IT'S COLDER

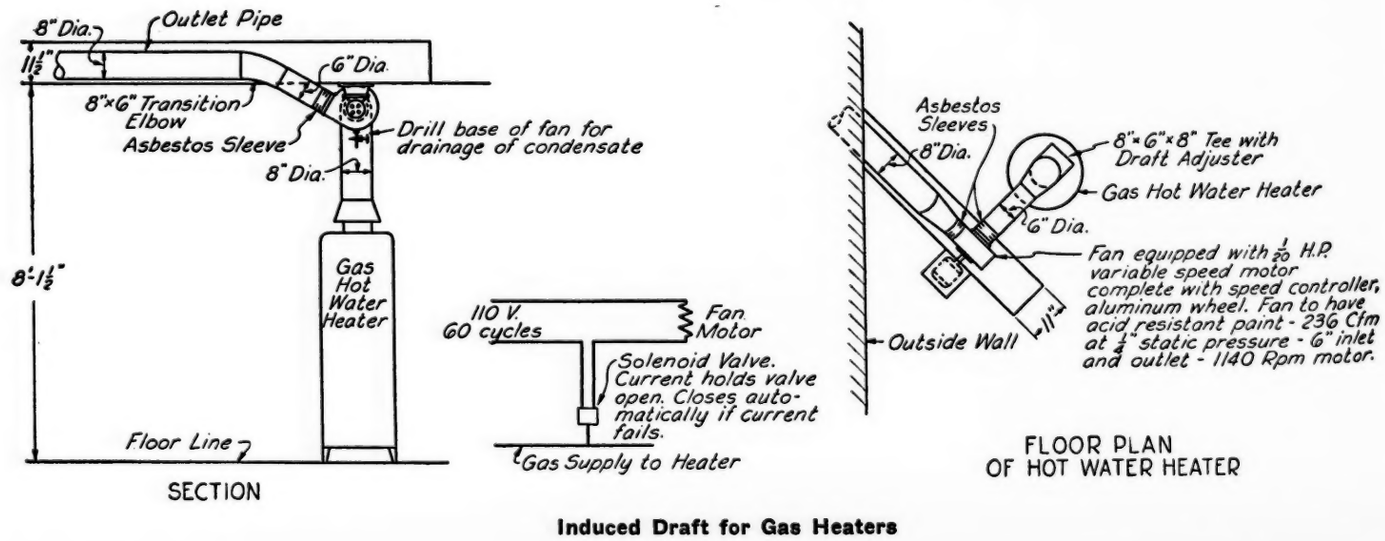
During the oil shortage the writer started his oil burner up rather late in the fall, but once he did this, felt colder after it had stopped than before it had run.

This happened for several days after the initial start. The writer has shivered and pondered over this phenomenon. Could it be that the accumulated moisture of woodwork and upholstery was absorbed by the air when it was hot and left behind in the air to increase the dampness whenever the burner stopped?

INDUCED DRAFT FOR GAS HEATERS

From the writer's data book, the accompanying arrangement for providing the necessary draft where a small structure is below ground, as in a park, and where the chimney must terminate just above grade.

Since the fuel is gas, it is necessary to adopt certain precautions for safety and for corrosion. The gas supply to the heater is closed automatically by a solenoid valve should the fan be stopped. The fan must be coated with acid resistant paint and have an aluminum wheel; also the base must be drilled to provide a drip point for drainage of condensate. Variable speed is provided.

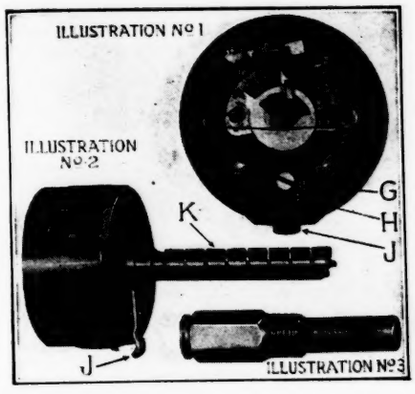

8" Dia.
Outlet Pipe
11½"
6" Dia.
8"×6" Transition Elbow
Asbestos Sleeve
Drill base of fan for drainage of condensate
8" Dia.
8'-1½"
Gas Hot Water Heater
Floor Line
SECTION
110 V. 60 cycles
Fan Motor
Solenoid Valve. Current holds valve open. Closes automatically if current fails.
Gas Supply to Heater
Asbestos Sleeves
8" Dia.
8"×6"×8" Tee with Draft Adjuster
Gas Hot Water Heater
6" Dia.
Fan equipped with 1/20 H.P. variable speed motor complete with speed controller, aluminum wheel. Fan to have acid resistant paint - 236 Cfm at ¼" static pressure - 6" inlet and outlet - 1140 Rpm motor.
Outside Wall
11"
FLOOR PLAN OF HOT WATER HEATER

Induced Draft for Gas Heaters

NEWS OF EQUIPMENT AND MATERIALS

Immersion Control

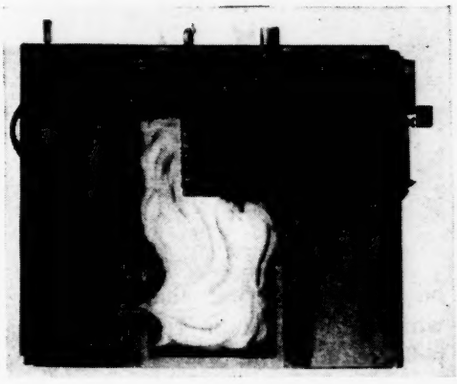
NAME— — Mercoid Type 437 immersion control.
PURPOSE — For use with automatically controlled steam or hot water boilers or storage tanks and wherever liquid temperature control is required.
FEATURES — Separable mounting well contains bimetallic element and allows removal of control without draining system. Temperature



range and differential can be set without tools by means of an outside knurled knob. Pointers indicate high and low temperatures on visible dial calibrated in degrees Fahrenheit. Small case, 3¾ in. in diameter, permits mounting in limited space. "On" or "off" position of hermetically sealed mercury switch is visible through cover window.
LITERATURE—Bulletin No. T-19.
MADE BY—*The Mercoid Corp., 4201 Belmont Ave., Chicago 41, Ill.*....544

Horizontal Boiler

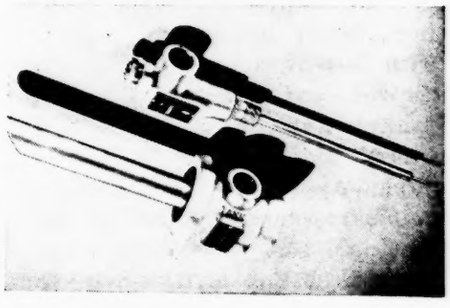
NAME—York-Heat oil fired horizontal burner.
PURPOSE—For heating medium and large size homes, small apartment houses and commercial buildings.
FEATURES—Boiler is built of 5/16 in. plate in two sections which can be assembled on job. Each section is sized to go through a standard doorway. Each tube contains a spiral baffle to increase heat transfer efficiency. Spiral can also be used as a tube cleaner. In upper part of boiler is located a trombone-type hot water for delivering domestic hot water. Water circulators keep the water in motion between the upper and lower sections. All boiler and combustion chamber parts are accessible for cleaning and maintenance. Unit uses a standard York-Heat burner matched to the boiler capacity.



SIZES AND CAPACITIES—Four sizes from 252,000 to 468,000 Btu per hour.
LITERATURE AVAILABLE — Bulletin RD-47-9.
MADE BY — *York-Shipley, Inc., York, Pa.*....545

Air Eliminator

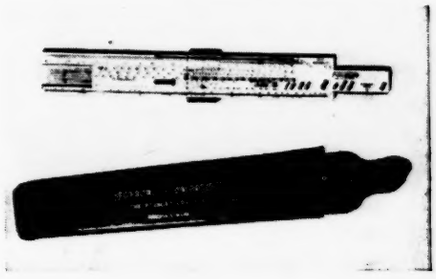
NAME—B & G Airtrol system.
PURPOSE—To eliminate accumulation of air in radiators of hot water heating systems.
FEATURES—System consists of two



basic parts, a boiler fitting and a tank fitting. In combination, units are said to trap air in compression tank and prevent its return to boiler, piping and radiators. Boiler fitting consists of a tube inserted in a T-shaped fitting which, in effect, extends the supply main down into the boiler water and prevents air which accumulates at the top of the boiler from rising into the piping. The air flows around the tube up into the pipe leading to the Airtrol tank fitting. The latter provides separate passages for air to flow to the top of the tank and for the water it displaces to flow back into the system.
MADE BY — *Bell and Gosset Co., Morton Grove, Ill.*....546

Slide Rule

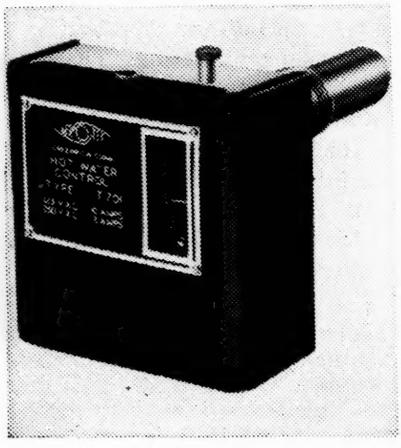
NAME—Foxboro flow-rule.
PURPOSE — For computing orifice plate bores, flow nozzles or Venturi throats, rate of flow, and differential created across orifice plate.
FEATURES—Slide rule can be used for computations for all fluids and for a wide range of flows and line



sizes. Its average error is said to be well within the accuracy of flow test data. The flow-rule is not intended to replace computation methods where purchase and sale of fluids are involved. The 12-in. rule is constructed with scales on white vinylite with a clear plastic covering to protect the scale markings. Instructions for operation are on the back of the rule. Slide rule was developed in operation calculations for B-29 bombers.
MADE BY—*The Foxboro Co., Book Department, Foxboro, Mass.*....547

Water Temperature Control

NAME—Aerotec T-701.
PURPOSE—To regulate hot water temperature.
FEATURES—Immersion type control is constructed of heavy gage steel with cadmium plated frame and bonderized cover. Microswitch is available in 110 v — 10 amp or



220 v — 5 amp normally closed. Outside scale permits setting of ranges between 60 and 200F by means of adjusting knob. Differential is fixed at 10F. Size, 3⅝ x 3⅝ x 1⅞ in. Mountable in any position.
MADE BY—Aerotec.
NATIONAL DISTRIBUTOR—*The Thermix Corp., Greenwich, Conn.*....548

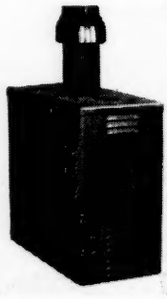
Close Coupled Pumps

NAME — "Close-Cupld" centrifugal pumps.
PURPOSE — For liquid pumping service.
FEATURES—Pump and motor are combined in a single assembly ready to install and operate in any position except vertically with motor below pump. Single shaft eliminates coupling. Machined stuffing box permits use of either a die-formed, semi-metallic packing with lantern type liquid seal ring or a mechanical seal. Full length shaft sleeve protects motor and shaft against damage. Provision is made for expansion and contraction of sleeve. Liquid deflector is drilled and tapped so that a spanner can

be used to prevent shaft rotation while tightening or removing impeller nut. New split gland, with halves held together with hollow washers which slip over bosses on the gland, make it unnecessary to unbolt gland when repacking.
SIZES AND CAPACITIES—Available in 17 sizes with capacities up to 2,000 gpm and heads up to 400 ft.
LITERATURE — Bulletin 710-1, 12 pages, 2 colors, contains specifications, efficiency and horsepower ratings, and dimensions of each size.
MADE BY — *Goulds Pumps, Inc., Seneca Falls, N. Y.* 549

Gas-Fired Boilers

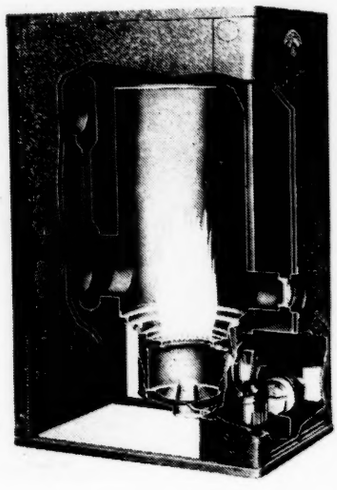
NAME—Hydrotherm automatic gas-fired central heating plants.
PURPOSE—Space heating by means of gas.
FEATURES—Unit has a horizontal heat exchanger which is said to provide a more compact unit. To facilitate handling and installation the absorption unit, boiler base with burner and control, and the jacket are delivered knocked down. Approved by the AGA, the unit burns natural, mixed, or manufactured gas.



SIZES AND CAPACITIES—Sizes for 600 sq ft or 1000 sq ft installed radiation.
MADE BY—*Hook & Ackerman, Inc., Pittsburgh, Pa.* 550

Gravity Oil Furnace

NAME—Superfex model 74 "Thermaflow."
PURPOSE—Small home heating.
FEATURES — Three-stage operation of oil burner provides pilot, coasting, and booster fires. Pilot and booster flames provide ordinary "on and off" operation while coaster flame provides steady flow of heat under conditions of moderate de-



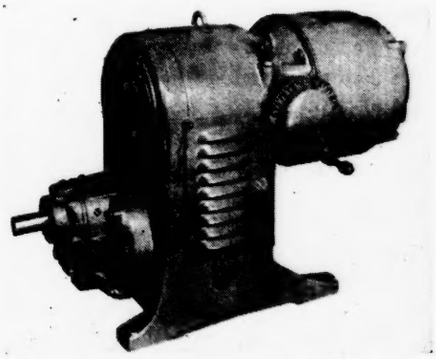
mand. Furnace is designed for basement installation. Capacity is 60,000 Btu at the bonnet. Operates on commercial grade No. 1 fuel oil or equivalent.
MADE BY — *Perfection Stove Co., 7609 Platt Avenue, Cleveland 4, Ohio.* 551

Porcelain Tank Lining

NAME—Apex porcelain.
PURPOSE — For lining pitted or leaky water tanks thereby to restore original usefulness.
FEATURES—Lining is applied in two coats approximately ¼ in. thick. Cures under water, thereby limiting shutdown period to time of applying. Has an affinity for lime, prevents corrosive and pitting action on metal. Makers claim it withstands temperature up to 250F without cracking or checking the tank.
MADE BY—*Apex Engineering Co., 205 West Wacker Drive, Chicago, Ill.* 552

Variable Speed Drive

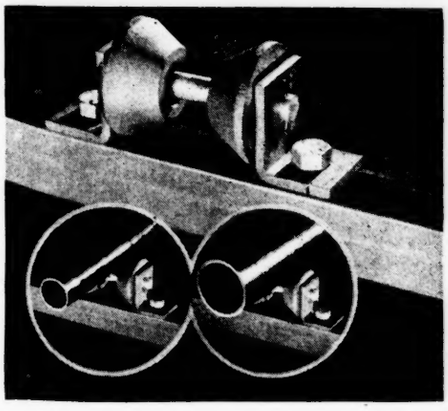
NAME—U. S. Varidrive, size 23.
PURPOSE—Motor with variable speed mechanism.
FEATURES—A variety of assemblies is available to fit almost any application such as horizontal frame with shaft left or right, upright frame



with shaft high or low, and built in speed reducers. Speed variations of 2:1 to 7:1 are obtainable with output up to 5 hp. With this new model, makers claim smaller size for a given horsepower, longer belt life, more convenient positioning of the speed adjusting handwheel, and an easier change of varibelts.
MADE BY—*U. S. Electrical Motors, 42nd St., New York 17, N. Y.*....553

Pipe Support

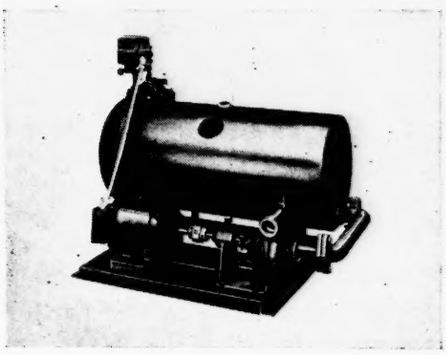
NAME—Unistrut roller pipe support.
PURPOSE—Roller support for pipe lines.
FEATURES — Two tapered rollers,



each with a slope of 30 degrees is mounted on a shaft so that it is possible to bring together the tapered rollers or to move them apart. This enables the roller to support pipe from one to 12 in. diameter, with only changes in the length of the axle.
MADE BY—*Unistrut Products Co., 1013 Washington Blvd., Chicago 7, Ill.* 554

Condensate Pump

NAME—Skidmore model HS pump.
PURPOSE—To meet low-price market for condensate pump.
FEATURES—Low receiver inlet with capacities of 1,000 to 5,000 sq ft E.D.R. and discharge pressure from 10 to 75 lb. Economy is said to re-



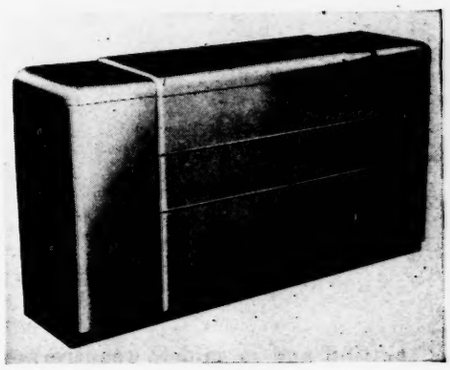
sult from simplicity of design and smaller motor size required. Made with a steel or cast iron receiver and mounted on a steel or cast iron base.
MADE BY—*Skidmore Corp., St. Joseph, Mich.* 555

Welding Electrode

NAME—Wilson No. 512.
PURPOSE—For welding of machining, hardenable, and cold rolled steels.
FEATURES—Provides mild steel weld metal with low hydrogen content. Can be used on a-c and d-c reverse polarity current with equal operating characteristics. Preheating of electrode is not necessary to obtain porosity-free weld deposits with either stringer bead or full weave technique.
MADE BY—*Dept. 1543P, Wilson Welder and Metals Co., Inc., 60 E. 42nd St., New York 17, N. Y.*...556

Schoolroom Ventilator

NAME—Trane unit ventilator for schoolrooms.
PURPOSE—For ventilation and heating of schoolrooms.
FEATURES—Unit uses the company's resilient belt drive mechanism. Recessed scuff board across the entire front is intended to eliminate unsightly mars. Corners of cabinet are rounded to avoid possible injury to small children. Inside is easily



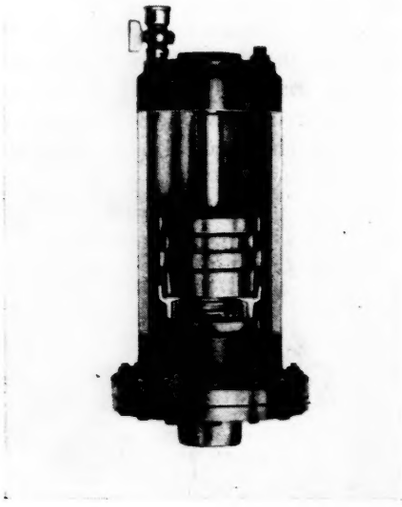
accessible so that pencils and chalk dropped through the grille can be removed. Unit uses a mechanically bonded fin-to-tube conduction.
MADE BY—*The Trane Co., La Crosse, Wis.* 557

Protective Coating

NAME — Metalast system of painting.
PURPOSE—Protective paint coating for metals.
FEATURES—Makers claim that this system of painting provides strong adhesion to all types of metals and high resistance to abrasion. System consists of the application of a Washcoat primer, a Metalast anticorrosive application, and a Metalast top coat which varies according to color desired and usage. Coatings will dry in about 20 minutes. Makers claim that, inside air conditioning ducts, coatings have withstood 100% humidity for 10 months without any sign of edge corrosion.
MADE BY—*C. A. Woolsey Paint & Color Co., Inc., 229 East 42nd St., New York 17, N. Y.* 558

Air Separator

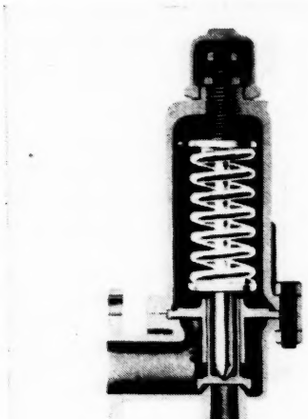
NAME—Model E air separator.
PURPOSE—For delivering clean, dry steam, gas and air.
FEATURES—Unit is mechanical in



operation and is said to require no attention other than draining off condensation that accumulates in the chamber. Inlet is at the bottom and the clean dry steam, gas or air is delivered from the outlet at the top.
SIZES AND CAPACITIES — Maximum rating is 250 cfm; size, 8 in. in diameter, 15 in. high with a 1½-in. standard pipe connection.
MADE BY—*Chicago Manufacturing and Distributing Co., 1928 W. 46th St., Chicago 9, Ill.* **559**

Valve

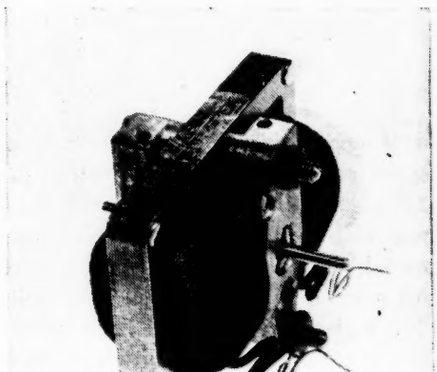
NAME—Farris corrosion resistant safety valve.
PURPOSE — Safety and relief valve for use with installations handling corrosive vapors or gases.
FEATURES—Special corrosion resistant alloy is used for the inserted nozzle and valve disc, and in some models, for the complete valve body. Working parts are isolated



behind a protective seal of flexible material attached to the disc at one end and the flanged disc guide at the other. Made in ½- to 2-in. sizes.
MADE BY — *Farris Engineering Corp., Commercial Ave., Palisades Park, N. J.* **560**

Small Motor

NAME—Gleason-Avery 4-pole single phase shaded pole induction motor.
PURPOSE — Fractional horsepower motor for operation on a-c current.
FEATURES—Motor coils can be adjusted to give a relatively high torque and large power input. Where duty cycle demands that motor be continuously energized, the winding is designed so that total temperature does not exceed about 190F. Motor may be assembled for clockwise or counter-clockwise rotation although rotation is not reversible after the motor has



been assembled. Unit is wound for 24 volt, 60 cycle a-c.
MADE BY—*Gleason-Avery, Inc., Auburn, N. Y.* **561**

Air Filter

NAME—Fiberglas air filter.
PURPOSE—For filtering dust from air circulated in air conditioning systems of railroad passenger cars and other railroad rolling stock.
FEATURES—A pack of glass fibers is enclosed in a chipboard container faced with a metal grille on both inlet and outlet sides. Unit is of replacement type and is available in thicknesses of 1, 2, 3 and 4 in. Relatively coarse fibers are placed on the air intake side and fine glass fibers on the air outlet side. Dust-catching adhesive is placed only on the fine fibers.
MADE BY—*Owens-Corning Fiberglas Corp., Toledo 1, Ohio.* **562**

OCTOBER, 1947

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

544	545	546	547	548	549	550
551	552	553	554	555	556	557
558	559	560	561	562		

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NEWS OF THE MONTH

U. N. CAPITAL

imposes exceptional problem in heat transfer through huge glass area.

The future world capital of the United Nations will be a city made largely of glass. The entire front of the secretariat skyscraper will look like a single window forty stories high. This effect will be brought about by huge double glass windows separated by slender strips of aluminum or stainless steel with three parallel metal strands running horizontally between floors.

• **MOTIF.**—Wallace K. Harrison, chief architect of the world capital, at the unveiling of a twelve-foot model of the headquarters illustrated on the front cover of this issue, described the buildings as having a glass motif throughout. There will be huge panes in both the front and rear entrances of the convex-shaped General Assembly hall. The hall itself is to be divided at the center by great walls of glass. The ground lobbies of all the buildings will be vast areas enclosed by massive panes, giving the effect of glass supports to all the buildings.

The most startling design in glass is in the secretariat building and in the tentative twenty-five-story structure for delegation offices. In these buildings, the architects plan to cover the basic structure on both broad sides with double facades of glass, which will be, actually, thousands of large windows closely connected.

The general glassy effect is heightened by the contemplated use of marble for the narrow sides of the buildings and for the pylons that are to decorate or support some of the units.

• **HEAT EXCHANGE.**—The architects plan about a foot of space between inner and outer windows on every floor. While detailed plans are incomplete, it is tentatively assumed by the planning office that these spaces will be used to augment the air conditioning system in conjunction with other means of controlling solar heat in summer and outward radiation through the glass in winter.

• **ENGINEERING.**—Engineering and technical studies, released in August by the headquarters planning office, proposed a total volume of all United Nations buildings of 30,000,000 cu ft. Some statistics may be of interest: A summer air conditioning load with all equipment electrically driven is estimated at 6,660,000 kwh. Using steam to drive air conditioning compressors imposes a steam demand of 82,000,000 lbs. for the season and reduces the electric load to 2,170,000 kwh. The refrigeration load is estimated at 6,000 tons which will require 18,000 gpm of East River water at 80F maximum. General power requirements for the air conditioning of the installation may be tabulated as follows:

Refrigeration compressors	6,000 hp
River water pumps	400 hp
Air conditioning fans	1,600 hp
Chilled water pumps	900 hp
	8,900 hp

The steam load for the heating season, October to May, is estimated at 84,000,000 lb for heating and 24,000,000 lb for hot water. Maximum demand is set at 60,000 lb per hr.

Three boilers are proposed for the group of buildings with two boilers in operation and one in reserve during the heating season. Fuel consumption for the year, with the air conditioning system electrically driven is estimated at 1,335,000 gallons of oil or 7,820 tons of coal. With air conditioning compressors steam driven, the estimate jumps to 2,240,000 gallons of oil or the equivalent of coal. With all air conditioning equipment steam driven, with the exception of circulating fans, the fuel estimate is set at 2,440,000 gallons of oil or 14,300 tons of coal.

HEAT RESISTANT DYES

reflect more infra-red radiation than other dyestuffs identical in color.

The reaction to infra-red radiation of the dyestuffs used in clothing is an important factor in their warmth or coolness, according to new studies and experiments made at the Philadelphia Textile Institute as part of a research project sponsored by the Philadelphia Section, American Association of Textile Chemists and Colorists.

• **EXPERIMENTS.**—Wool, cotton, cotton duck and rayon fabrics identical in every respect, including color, but dyed with different commercial dyestuffs, were used in the experiments conducted at the Philadelphia Textile Institute. Because of difference in the infra-red absorption characteristics of the dyestuffs used, the dyed fabrics, although identical in color, varied as much as 14F in temperature under prolonged exposure to sunlight.

• **ICE-MELTING.**—The heating effects on fabrics resulting from the varying infra-red characteristics of dyes is illustrated strikingly by the following experiment:

Two pieces of the same wool fabric are dyed black, one with Pontacyl Blue Black RC which is low in infra-red absorption and therefore reflects most of the infra-red in sunlight, and the other with Chromacyl Black W which absorbs most of the infra-red. The two fabrics are identical in appearance. Rectangular pieces of the two fabrics are laid over blocks of ice of the same size. Then they are placed side by side under infra-red lamps, which produce energy similar to that from the

sun but at higher intensity and at a uniform rate. The experiment can be conducted equally well in sunlight, but it is slower and more troublesome because of varying sunlight intensity. Under the infra-red lamps, the ice melts very much faster under the fabric dyed with the high infra-red absorbing Chromacyl Black W than under the low infra-red absorbing Pontacyl Blue Black RC.

• **BURNING.** — Another interesting experiment also illustrates the heating effects resulting from infra-red absorption:

Two pieces of the same cotton poplin are dyed brown, one with Pontamine Brown BT, which reflects most of the infra-red and therefore is low in infra-red absorption, and the other with Ponsol Brown BB, which absorbs most of the infra-red. The samples are mounted side-by-side under high-intensity infra-red lamps. The fabric dyed with Ponsol Brown BB heats up rapidly, chars and then burns; while the fabric dyed with the low-absorbing Pontamine Brown BT merely becomes somewhat warmer.

In a leaflet entitled "How Cool Is Your Color?" the institute points out that new discoveries concerning the wide variations in infra-red absorption characteristics of commercial dyestuffs "may prove of substantial significance to the textile and apparel industries and strongly influence the clothing habits of the American public."

BILLION-DOLLAR BACKLOG

in Catholic construction results in national convention to study and expedite parochial building.

A multi-billion dollar construction program covering every phase of Catholic parochial building (churches, schools, convents, rectories, union buildings, etc.) as well as every phase of Catholic institutional building (hospitals, homes for the aged or infirm, colleges, etc.) lies in the immediate future and is the direct responsibility of pastors, mothers-general, college officials and others.

Because of the continued lag in materials, equipment and labor supplies only "emergency" construction and remodeling jobs are being undertaken at this time. The full movement of all Catholic construction projects may not get under way for considerably more than a year.

• **CONVENTION.**—In order to bring the pastors, mothers-general and others interested in Catholic building and remodeling together with representatives of the building industry, and to prepare the former for a better understanding of the problems involved in these projects, the National Catholic Building Convention and Exposition has been arranged for June 30, July 1, 2, and 3, 1948, at the Stevens Hotel, Chicago.

• **WHAT IS IT.**—The National Catholic Building Convention and Exposition is a not-for-profit Illinois corporation organized by the Business and Industry Foundation of the college of St. Joseph's of Indiana with the full approval and endorsement of His Eminence Samuel Cardinal Stritch, of Chicago, and with the full approval and endorsement of other leading Catholic churchmen.

• **OFFICERS.**—The honorary chairman of the undertaking is His Eminence Samuel Cardinal Stritch of Chicago. Active officers are:

President, the Very Rev. Henry A. Lucks, C.PP.S., Ph.D., president of St. Joseph's of Indiana; vice-presidents, James V. Malone, editor and public relations counsel, and Frank J. Graves, business executive; treasurer, the Rev. Francis A. Hehn, C.PP.S., C. P. A., vice-president of St. Joseph's of Indiana; secretary, the Rev. Henry J. Martin, C.PP.S., of the faculty of St. Joseph's of Indiana.

• **PURPOSE.**—It is estimated that the National Catholic Building Convention and Exposition will bring to the Stevens Hotel in June, 1948, about 5,000 pastors, mothers-general, college officials and others interested in Catholic parochial or institutional building and remodeling. The program planned will cover every phase of building and remodeling from city planning and site selection, through design, engineering, architecture, contracting, materials selection, equipment layout and selection, furnishings and decoration. Outstanding authorities from all divisions of the building field will speak on the detailed subjects, with question and answer periods following. Morning sessions will be held in the grand ballroom and will be general in nature; afternoon sessions will be panels on specific types of buildings: schools, rectories, churches, etc.

The exposition will be held in the exhibit hall of the Stevens Hotel and will comprise exhibits of manufacturers of all products going into Catholic building or remodeling.

• **BACKLOG.**—Cardinal Stritch estimates that in the Chicago archdiocese alone more than $12 million will be expended within a two- to three-year period. Mercy Hospital alone will spend $6,000,000. In New York City, Cardinal Spellman estimates the Alfred E. Smith Memorial Hospital will cost $7,000,000 while the Archbishop Stepinac High School will cost $4,000,000, and the New York Foundling Hospital $3,000,000. These are only isolated examples and do not include the millions which will be spent for building and remodeling by thousands of pastors, mothers-general and college officials.

Two offices are maintained. James V. Malone, first vice-president and general chairman, is in charge of the Chicago headquarters in the Chicago offices of St. Joseph's of Indiana at 185 N. Wabash Avenue, Chicago 1, Ill. The Business and Industry Foundation offices are on the campus of St. Joseph's of Indiana at Collegeville, Ind., and are in charge of Richard M. Scheiber.

Edward C. Bowman, with offices at 8 S. Michigan Avenue, Chicago 2, is the convention and exposition manager. Mr. Bowman is in charge of the sale of exposition space and of all contacts with the Stevens Hotel relating to the exposition.

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BASIC DESIGN

developed by house building industry to cut construction costs through standardization.

After 22 months of study by engineering and technical experts in more than 100 companies and trade associations, the home building industry has developed a basic standardized dwelling design principle intended to reduce building costs substantially.

• **WHO.**—Sparked by efforts of the National Retail Lumber Dealers Association, the Producers Council, and 42 cooperating business associations, the plan will be tested at the University of Illinois under contract with the Office of Technical Services of the Department of Commerce. Work has been started at the university on construction of six demonstration houses which will be of various sizes and utilize different types of materials and construction methods.

• **THE PLAN.**—A. Gordon Lorimer, New York architect and engineer, who directed much of the technical research, said the key to the design system is the use of standard 4-ft lengths and multiples of this length, permitting all parts to fit with a minimum of cutting or adjustment.

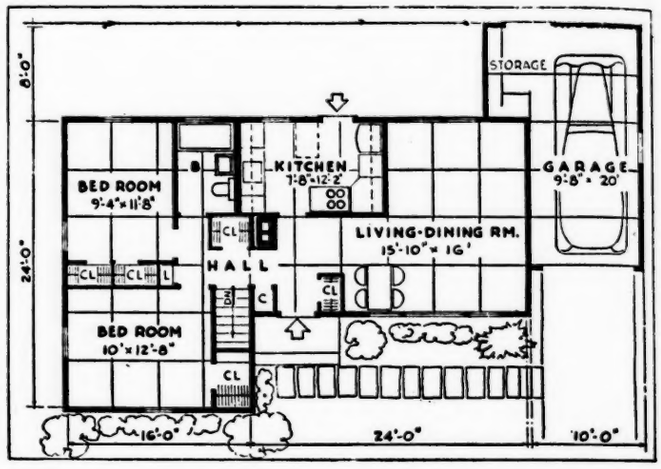
The system, to be sponsored by 25,000 dealer-distributor organizations, will require no re-tooling or development of new techniques by the manufacturers. It is based on materials and sizes now available, so a builder can take advantage of the plan as soon as he has familiarized himself with the details and suggested methods of construction.

• **PRINCIPLES.**—Larry C. Hart, of Johns-Manville, chairman of the manufacturer-dealer coordinating committee, emphasized that this was no "model home" to be repeated in monotonous fashion, but was a "set of basic principles" for any type of architecture or size of house so long as the designer stuck to the four-foot standard, which was found most feasible for use of available sizes in wallboard, lumber, bricks, cement blocks, plumbing fixtures and other products.

The sponsors engaged Mr. Lorimer and Randolph Evans, also a New York architect, to develop demonstration designs. The first two of these houses, one of wood and one of masonry, already are going up at the University of Illinois.

• **HEATING.**—Representatives of heating equipment manufacturers on the coordinating committee limited their recommendations to the placing of chimneys and central heating equipment to allow greatest flexibility of design without actually entering into engineering specifications. For instance, in the panel heating of non-basement homes, placement of a utility room of dimensions in basic units so that central heating equipment is in the center of gravity of the house is recommended.

• **UNITS.**—The standard housing unit is a one-story affair, 16 ft wide and 24 or 28 ft in length. Two units can be used if desired, either in a one-story L-shaped layout or one over the other to form a two-story home. Each would have two bedrooms.



Space and fabrication economies are effected by use of basic units in floor plan. Note single "wet wall" for kitchen and bathroom.

The 16-ft width was chosen, Mr. Lorimer pointed out, because this was the greatest span that could be used safely for 2-by-10-in. floor joists supported only on the two ends.

The 16-ft span also permits use of a simple tied-rafter type of roof truss, easily assembled on the floor and lifted into place by two men. The 24-ft and 28-ft lengths were chosen because they were convenient multiples of the standard 4-ft factory-built wallboard and exterior coverings. Such lengths also permit equal spacing for joists and studs placed either 16 or 24 inches from center to center.

The committee recommends finished flooring and ceiling materials be installed before inside partitions are erected. The inside partitions support no weight but their own. Closets and storage walls thus can be pre-assembled.

Further economies are obtained by placing the bathroom and the kitchen in back-to-back fashion, so that virtually all plumbing, pipes and wiring can be carried in one wall. In the two-story unit the bathroom is directly over the kitchen.

• **SAVING.**—No estimate was made by the sponsors on the cost of the basic house because of sectional differences in prices and wages. Some experts estimated the standardization should provide the basis for a reduction of at least 10 per cent from costs encountered in building by ordinary methods.

AIRPORT SNOW REMOVAL

speeded by gigantic flatiron which melts and wipes dry at 15 mph.

A Pittsburgh engineer, John B. Sweeney, who has an annual battle with snow and ice at the airports in Pittsburgh under his control, has come up with a device designed to wipe out those menaces to year-round operation of airlines. The device operates like a gigantic flatiron, weighing 12 tons and literally iron-

THE TRUTH ABOUT RADIANT PANEL HEATING

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- **Will it save me money on fuel?**
- **What are its disadvantages?**
- **How does it really work?**

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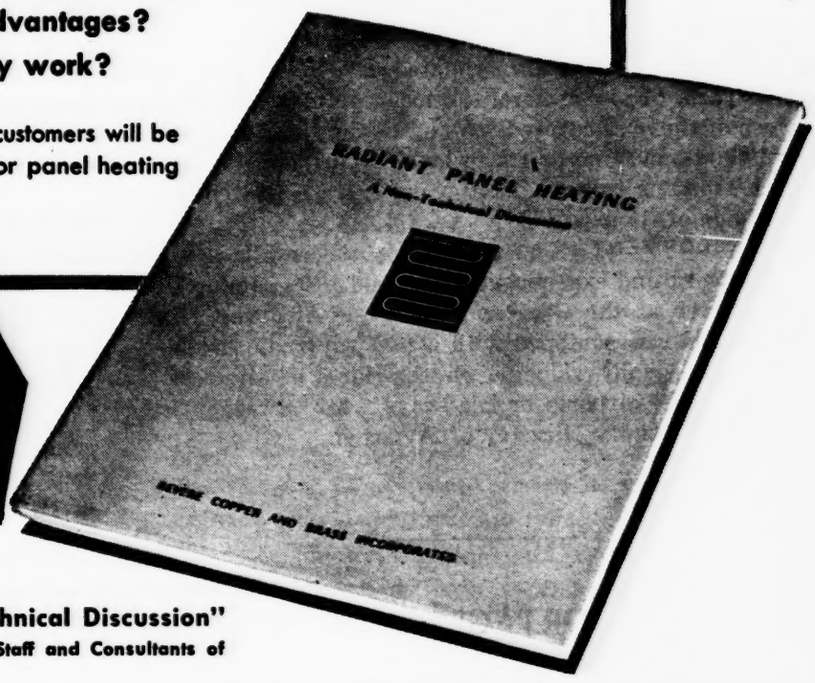

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ing out the ice and snow completely on a 12-ft swath of runway or roadway. It melts the snow and ice by means of two wide combustors which focus a blast of oil-fired 2,000F air on the area to be cleared.

• **WATER.**—It travels at the rate of 10 to 15 miles an hour. It is mounted on an ordinary grader, and water that the great heat does not evaporate is wiped from the pavement by a large squeegee blade, working like an ordinary window cleaner. A relatively small amount of water is formed by the melting snow, since the water content of snow is only 2% of its volume. When not in use the snow remover can be removed from the grader in a couple of hours and stored.

• **HEAT.**—The 2,000F blast is forced down to the runway through blowers operated by an air-cooled engine, the blast gaining its terrific heat from oil burners consuming 30 gallons an hour. Although they produce 8,000,000 Btu per hour, the pavement is not damaged because of the speed of the machine and the fact that it is used in cold weather. Mr. Sweeney's machine will remove snow at an estimated cost of one cent a cubic yard. Furthermore, the machine makes a clean sweep of the area covered, leaving no icy spots to cause skids and leaves no drifts to be cleared from the side of the road or runway, melting an extra 5-ft strip on each side of its path.

• **DEVELOPMENT.**—The machine is the result of six years' work and experiment, with field tests conducted last winter at the Greater Pittsburgh Airport. His first model was equipped with a two-way radio, which would be equally valuable on any kind of snow removal work—airports or roadways. Mr. Sweeney is Allegheny County Director of Aviation.

DRY ICE SHORTAGE

affects rain-making and refrigeration operations.

Rain makers, both amateur and professional have tried to help nature across the drouth ridden sections of the country recently, but have had only scant supplies of dry ice with which to conduct their operations. Robert Mathie of Liquid Carbon Corp. says that demand for the material for refrigeration purposes is far beyond the industry's capacity to produce it. He added that peak of the demand of the commodity for that purpose came in July and August, the dry months when rain was also needed.

• **CAPACITY.**—Fred Aalbue, superintendent of Liquid Carbonic's plants in the United States and Canada says that the entire industry is trying to expand its present annual capacity of 400,000 tons, but that a shortage of heavy machinery, such as compressors, blowers and boilers dims much prospect of expansion for several years. "The industry is running about 20% behind the demand," he says. "Whether the ice is natural or synthetic, much the same equipment is needed and much the same shortages exist. We're in the same fix as the rest of the chemical industry."

• **COSTS.**– Costs of producing rain vary. Dry ice costs around five cents a pound, and plane rental and pilot hire for dropping the dry ice pellets into cloud formations must be added to that. Many experimental rain producing flights have been carried on by newspapers and radio stations. In Texas, Oklahoma, Arizona, New Mexico, Missouri, Louisiana, Illinois and Iowa successful rain experiments were carried out, but in Nebraska three attempts were failures. Some in Iowa were not too successful. Results have ranged all the way from slight sprinkles to real "soakers" lasting 35 to 45 minutes. Most of the flights were made for farmers to get moisture for their crops, but in Richmond, Va., a flier dumped 50 pounds of dry ice into a cloud just to cool off the city, which had had no rain for two weeks. At Los Angeles firefighters failed to put out a canyon fire with dry ice rain, but a natural rain next day doused the blaze.

INSTRUMENT ENGINEERS

turn out in force at second annual instrument conference and exhibit.

Over 7000 instrument engineers, production executives, chemists, and instrument men attended the Second Annual Conference and Exhibit at the Stevens Hotel, Chicago, the week of September 8th.

The instruments and control devices shown by 135 companies and 4 governmental agencies in 147 booths represented a value of $6,000,000. The display space was 12,919 sq ft.

The technical program was sponsored jointly by the Instrument Society of America and the Industrial Instruments and Regulators Division of the American Society of Mechanical Engineers.

The next annual meeting of the Society will be in Philadelphia, September 13-17, 1948. The 1948 Exhibit, covering 20,000 sq ft, will be set up in the Convention Hall.

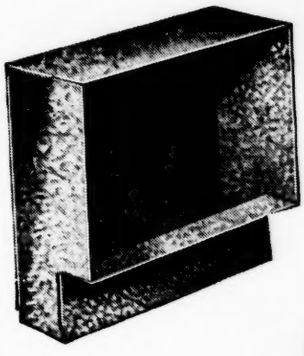
PIPE LINES

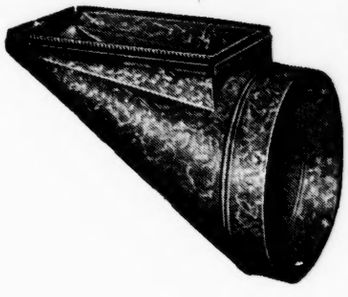
to deliver more gasoline, fuel oil to Midwest through line improvements.

Pipe line facilities of Shell Oil Co. in the Midwest are being modernized and reconstructed to carry an additional 336,000 gallons per day of gasoline, fuel oil, and other petroleum products.

• **FACILITIES.**—Two eight-inch pipe lines will be involved, which carry finished petroleum products north and east from Shell's refinery at Wood River, Illinois. One line terminates at East Chicago, Indiana; the other, at Lima, Ohio, with an extension to Springfield and Columbus.

Your JOBBER does a man-sized job!





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FURNACE PIPE AND FITTINGS

CLIMATIC HANGAR

provides all-weather, year-around testing facilities for Army Air Forces planes and equipment.

The Army Air Forces require that all aircraft, aircraft ground and personal equipment used by the Air Forces operate satisfactorily under all climatic conditions or be capable of operating satisfactorily after undergoing minor modifications. The operating temperature criterion sets forth a range from —65F to +165F. All design and manufacture must be directed towards operating under these conditions.

To meet the Army Air Forces requirements and to insure satisfactory functioning of aircraft and equipment in all theaters of operation during all seasons of the year, a climatic testing program has been established. The function of this program is to test all aircraft and equipment to determine its satisfactory performance in extreme climatic conditions and its effective life when subjected to these conditions.

To overcome the difficulties of field testing and make possible year-'round testing under controlled temperatures and other climatic conditions, the climatic hangar has been constructed at the Air Proving Ground Command, Elgin Field, Florida.

• **TESTING FACILITIES.**—The climatic hangar project consists mainly of an insulated hangar 200 ft by 250 ft, 70 ft high; an equipment and engine test room 30 ft by 133 ft, 25 ft high; a cold test room, hot test room, desert test room, jungle test room, and tropic-marine test room, each 13 ft by 13 ft; an all-weather room for physiological testing, 13 ft by 34 ft; and a refrigerated strato-chamber, 10 ft by 14 ft.

The temperatures within the hangar and test rooms can be maintained within a range from —70F to +165F. Relative humidities can be maintained within a range of 10% to 95% or 1.5 in. mercury vapor pressure, whichever is lower when temperatures are maintained in the range of 50F to 165F. There is no provision for controlling relative humidities at temperatures lower than 50F. Provisions have been made for localized wind storms up to 100 mph in combination with sleet, snow, rain, dust, and sand. Artificial sunlight equivalent to noonday desert sun is provided. Thus all normal and extreme climatic conditions can be simulated within the hangar or test rooms. There are no provisions for operating the hangar under reduced pressures. However, a refrigerated variable pressure chamber (strato-chamber) is provided for high altitude and climb testing of personnel and personal equipment.

• **TYPES OF TESTING.**—The great size of the hangar makes it possible to subject the largest military airplane now designed and under construction to climatic functional testing. Facilities are provided so that all types of aircraft, including jet engined and prop-jet aircraft and their parts, can be tested.

• **FLOOR.**—The floor consists of a working surface of 12 in. of reenforced concrete laid in blocks 12½ ft square. This surface is designed for a 150,000-lb concentrated load which gives bearing strength for a 300,000-lb airplane. The reenforced concrete rests on insulation of 15 in. of cellular glass block, vapor sealed with roofing felt on top and bottom. The top layers of felt are approximately ½ in. thick and provide a cushion between the reenforced concrete slab and the insulation. An 8-in. concrete slab forms the sub-floor structure. One-inch, mastic-filled, copper-flashed, expansion joints in both slabs allow for expansion and contraction with temperature changes. The copper flashing prevents water from leaking into the insulation. The top slab is graded toward sixteen 6-in. drains uniformly spaced over the floor. Aircraft grounding connections, tow rings, tie down anchors, and test service ducts and openings are conveniently located to facilitate testing procedure. Heat transmission of the floor is approximately .025 Btu per hr per sq ft per degree temperature difference.

• **CEILING.**—The method of supporting the insulated ceiling is a unique design. The ceiling is built on the top of a corrugated steel deck. This deck is supported on I beams which are hung from the trusses by chains. Except for a few electrical conduits, the chains are the only members piercing the insulation, and thus, the heat transfer through the insulation by structural members is small. The chains allow the ceiling to be semi-flexible and this assists in accommodating it to thermal expansion. Expansion and contraction is accommodated between sections of the steel deck by "U" metal inserts. Special rubber sections are provided to allow for the two directional movement, which takes place at the intersection of the longitudinal and transverse expansion joints.

• **MAIN DOOR.**—The main hangar door which closes the open side of the hangar is self-supporting and self-propelled. It is built in two sections, each weighing 200 tons. The trucks supporting the sections run on pairs of rails 25 feet apart. When the sections move into place to close the hangar, hooks on the sections engage in catches about the perimeter of the opening. A power drive draws up on the hooks and the sections move toward the hangar approximately 6 in. sealing sponge rubber gaskets to form a tight seal around the opening. Also, a cam forces rubber pads at the bottom of the door into contact with the hangar floor. The main door can be opened in seven minutes. A vertical lift door 50 feet wide and 15 feet high is located in the north half of the main door. This door is counter weighted and electrically operated. An entrance lock is being designed for this door so that small aircraft and other equipment can pass through this opening without loss of hangar air. The 50 foot door can be opened in 2 minutes. The entire door is insulated with 13 inches of glass wool board inclosed on both sides with welded steel vapor barriers.

• **DOOR HEATERS.**— During cold testing, it will be necessary to prevent doors' freezing tight due to frost which forms around the joints. To prevent this all doors are provided with strip heaters which are installed around the entire perimeter in contact with the metal pressure plates. These strip heaters liberate

Producing Nylon yarn in an atmosphere of controlled humidity at Lehigh Valley Throwing Mills. The air is circulated through ceiling ducts made of Beth-Cu-Loy Galvanized Steel Sheets.

Humidity control in a modern throwing mill improves the running quality of yarn as it spins on high-speed bobbins. It eliminates the static snarls that happen when fibres are too dry. It reduces the breakage of the filament-like material that occurs when there is too much moisture present.

These advantages explain why proper control of humidity is a "must" for smooth, low-cost production in the highly-competitive textile industries.

Ducts that circulate humidified air in plants of this type must be able to withstand more than average corrosive conditions. That is why Beth-Cu-Loy Galvanized Steel Sheets are specified for ductwork in many of the country's leading textile mills. Beth-Cu-Loy Sheets have a copper-bearing steel base whose resistance to rust is from 2 to 2½ times that of ordinary carbon steel. In addition, they have a bright, even coating of Prime Western zinc that acts as an outer protective armor against corrosion.

Whenever you figure on an industrial air-conditioning or humidity-control job remember Beth-Cu-Loy Galvanized Sheets will give far longer service—and cost very little more than ordinary sheets.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

Beth-Cu-Loy Galvanized Sheets

BETHLEHEM STEEL

approximately 15 watts per linear inch when power is on. A thermostatic switch maintains just enough heat to prevent freezing.

• **WALL INSULATION.**—The side and rear walls of the hangar are insulated with 13 in. of glass wool board inclosed on both sides with 22 gauge galvanized sheet metal welded on the inside and soldered on the outside. The insulating material is erected without asphalt binder and is supported with wood framing. Thermal contraction and expansion of the insulation is restricted by the close spacing of the framing. Thus, the overall displacement of the insulation at any point will be small and cracks should not develop. The insulation is erected in three layers, 4, 5, and 4 in. thick respectively. The outer layers are framed vertically and the middle layer horizontally. Expansion and contraction of the vapor barriers are permitted by "V" expansion joints at 10-ft centers.

• **ENGINE EXHAUST AND VENTILATION.**—Because of the large volume of the hangar—2,900,000 cu ft—engine runs of short duration can be made without special provisions for the exhaust gases. Detecting apparatus will give an alarm when carbon monoxide reaches the danger point and engine tests will then be discontinued until the normal ventilation of the hangar space has reduced the carbon monoxide concentration to a safe point. The normal ventilation of the hangar varies from approximately 5000 cfm at low temperatures to 30,000 cfm at high temperatures.

To make possible the running of engines in the hangar for periods longer than one or two minutes, exhaust gas systems are provided so that exhaust gas can be piped directly from the engines to the outside.

• **AIR CONDITIONING UNIT.**—The air conditioning system which supplies the hangar and equipment and engine test room consists mainly of five elements; a refrigeration plant employing approximately 100,000 lb of Freon-12 and producing 780 tons of refrigeration at —70F, a steam heating plant, an air delivery system, a series of cooling and heating coils in the air delivery system which are heat exchangers between the air and cooling medium (Freon-12) on the cooling cycle, and the air and the heating medium (steam) on the heating cycle, and a cooling tower for cooling water used in the refrigeration condensers.

On low temperature tests, the system is capable of reducing the temperature of the hangar and its contents to —70F, based on summer outside conditions, within 48 hours. Following the initial reduction of temperature a period of 24 hours is allowed for stabilizing the temperature before any heat producing tests are started. After the temperature has become stabilized and is —70F, an internal combustion engine can be started from zero output and gradually increased at a uniform rate for 10 minutes up to 160,000 Btu per minute heat output into the hangar and continued 10 minutes at this rate. (This represents the output of a 2500 hp engine). The temperature in the hangar will not rise more than 5F by the end of this 20-minute test. Four consecutive 20-minute tests at one hour intervals are possible. The temperature at the end of the four tests will be approximately —60F.

For hot tests the hangar can be heated from 25F ambient to 165F in 16 hours without any internal heat source.

• **REFRIGERATION MACHINERY.**—The refrigeration machinery plant consists of:

3 Freon-12 two-stage condensing and cooling systems, each system consisting of the following equipment:
1 1250 hp centrifugal compressor—high stage
1 1000 hp centrifugal compressor—low stage
1 Condenser—where refrigerant gas is condensed to a liquid by cooling water
1 High stage intercooler—where the liquid refrigerant from the condenser is further cooled by expansion
1 Gas and liquid cooler—where gas from the low stage compressor and liquid from the high stage intercooler are further cooled by expansion.
1 Low stage intercooler—where liquid from the gas and liquid cooler is further cooled by expansion.
1 Surge receiver—which is the final expansion chamber in the system. In this receiver a portion of the liquid refrigerant is circulated through the cooling coils in the air delivery system to absorb heat from the air. The liquid refrigerant at this point will leave the receiver at approximately —94F when the hangar is maintained at —70F.
1 Storage receiver—where the refrigerant is stored during shutdown of each system.

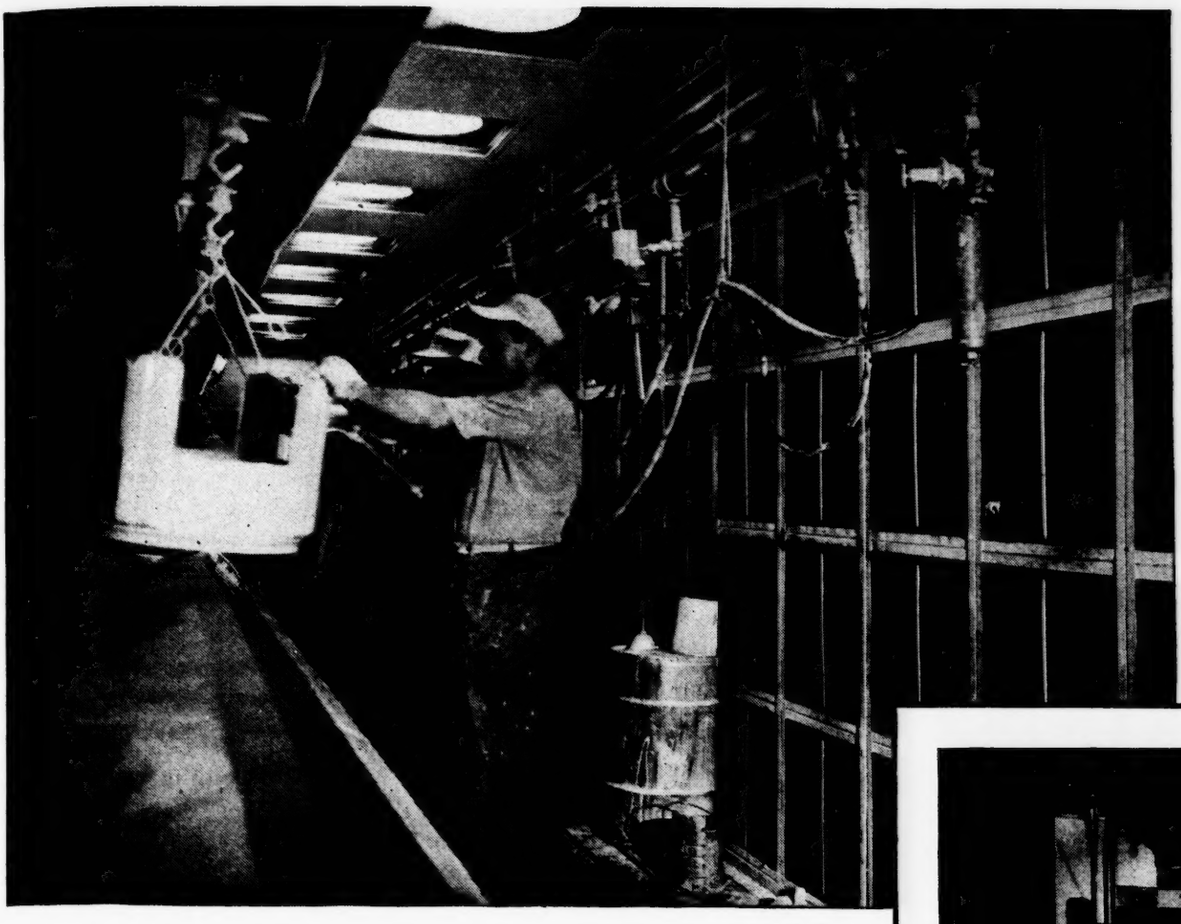
There is also one 125 hp refrigeration system used for cooling the outside air required for ventilation during cold tests. It also has a dual purpose, in that it can be used to pump out or transfer the refrigerant in the cooling coils and apparatus of the main systems to the storage receivers of each system. This eliminates the necessity of operating the larger machines to pump the refrigerant to the storage receivers.

• **COOLING TOWER.**—An induced draft cooling tower furnishes the necessary atmospheric cooling of the water used in the condensers. A total of 6400 gpm of water is cooled from 94F to approximately 85F with outside air at 80F wet bulb. The tower is provided with three 30 hp fans for induced draft.

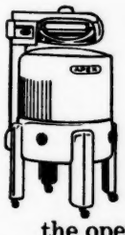
• **FLUSHING.**—In case of poisonous gas or explosive vapor reaching a dangerous concentration, the hangar or test room can be flushed by the manipulation of plenum doors. Maximum flushing rate is 470,000 cfm.

• **STEAM HEATING PLANT.**—To provide heating for the office and work space during winter periods, and also for the high temperature conditions within the hangar and test room, a complete boiler plant is provided. This equipment is located in a separate building situated immediately southeast of the hangar.

Two duplicate B. & W. Sterling type cross drum water tube boilers, each having a 310 boiler horse power rating are installed. Each boiler is equipped with double burners designed for bunker C No. 6 oil. In addition, there is one horizontal fire tube oil fired boiler for supplying steam for light heating.



DUST-STOPS help give *Apex* washers a superior finish



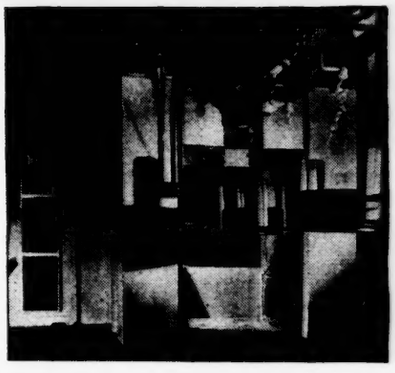
Here's an important section of the production line in the Apex Electrical Mfg. Co. plant in Cleveland, Ohio. It's the spray booth where DUST-STOP Air Filters (behind the operators and in the air intake areas at the doorway) prevent dust, dirt and foreign matter from causing costly damage. DUST-STOPS also protect electrical controls and other equipment from air-borne paint.

Because DUST-STOPS can be replaced easily and economically, maintenance time and costs are kept at the minimum.

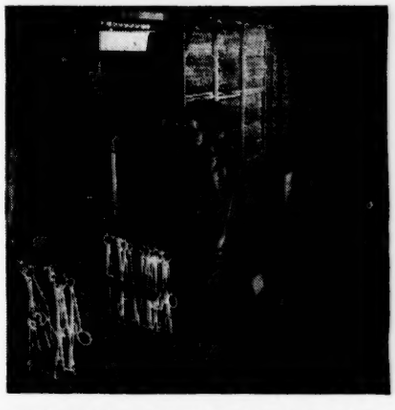
DUST-STOP Air Filters are used in commercial and industrial heating, ventilating and air conditioning systems of all sizes. They may be installed in custom-built or the complete, ready-to-assemble, steel frame cells—*to handle any cfm of air required.* And DUST-STOPS are readily available from suppliers in nearly every community.

See Sweet's Files for complete information or write for booklet—"Air Filtration in Central Systems" (A 5.2.1), Owens-Corning Fiberglas Corporation, Dept. 912, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario.



DUST-STOPS are adaptable to a wide range of requirements—in huge buildings or custom-built areas.



DUST-STOPS mounted on this sliding door provide filtered protection for sensitive electrical controls.

DUST STOP* AIR FILTERS
a Fiberglas product

*T. M. REG. U. S. PAT. OFF.

All boilers are designed for an operating pressure of 125 lb per sq in. The water tube boilers are equipped with complete automatic control within the limits of the design capacity, or any part of the equipment can be manually controlled, if desired.

The heating plant is complete in every detail. Some of the special refinements in addition to the usual boiler feed pump, fuel oil heaters, draft and water gauges, etc., are the following: steam flow meters, induced and forced draft fans, soot blowers, portable ignition burner, and special condensate feed water heater. There are also many safety features such as non-return valves, electrical eyes for burner failure detection, and furnace air pressure regulators for the burners.

NEWS BRIEFS

• The Heating Branch of the Air Installations Section, Tactical Air Command, Langley Field, Virginia, has a vacancy for a qualified heating engineer. This position is classified under Civil Service and carries a yearly salary ranging from $4902.00 to $5905.00.

Applicants for this position should submit a Civil Service Form No. 57 which may be secured from any Post Office or Civil Service Representative.

• The Federal Power Commission began hearings in late September to review complaints of opponents of the certificate application by Texas Eastern Transmission Corporation to use the Big Inch and Little Big Inch pipe lines for the transmission of Texas natural gas to Philadelphia.

• Operation of the Big Inch and Little Big Inch pipe lines netted the U. S. Government $182,000,000 in the period from January, 1943, through October, 1945. This fact was revealed in a letter from Chairman John D. Goodloe of the Reconstruction Finance Corporation to W. Alton Jones, president of Cities Service Co., who headed up War Emergency Pipelines, Inc., which built and operated the Big and Little Big Inch.

• Out of every 100 persons who build houses for their own use, 74 do not sell the house during their life time, says the Plumbing and Heating Industries Bureau on the basis of statistics on home ownership for the last two decades.

• A letter to William B. Henderson, executive vice-president of ACRMA, from the office of the Commissioner of Internal Revenue states that new facts submitted by manufacturers regarding air conditioning units known in the trade as *store or office coolers* have resulted in reconsideration of their taxability and therefore sale of such articles by the manufacturers are *not subject to tax.* New decision based on need for ducts, structural changes and high voltage current in installation of this type of equipment.

• Final Bureau of Mines statistics covering *anthracite production* for 1946 show an 11.4% increase over the 1945 level. Production in 1946 was 57,310,488 tons. Over half the gain in total production was accounted for by stripping, which reached the all time peak of 21.7% of the total.

• Knowledge about *properties of gases* with relation to jet propelled engines and rockets will be organized in a project sponsored by the Engineering Foundation, 29 W. 39th St., New York City.

• *Coal Heating Service* groups, sponsored by the National Coal Association as a means of providing 24-hour service to coal consumers, numbered 885 members in twenty-two groups as of September 19. The estimated tonnage handled by CHS members is 8,908,077 tons, said to be more than 75% of the total tonnage handled in the areas where CHS groups have been organized.

• Largest single *rental housing* project yet started under the new FHA program providing rental housing for World War II veterans and their families is Meadowbrook Apartments in Indianapolis, comprising 640 units and financed with a mortgage of $4,792,500 insured by FHA under Title VI of the National Housing Act.

• The antifreeze properties of glycerine are called into use in a special gasket developed by W. McK. Baird for use in refrigerated systems. According to U. S. Patent 2,414,009, such a gasket may consist of an outer covering of antifreeze absorbent material, like canvas; a filler of antifreeze absorbent material, such as cotton; and a hollow core of flexible material, such as rubber. The covering and the filler are treated with glycerine to provide the desired antifreeze properties. With these gaskets, the doors of refrigerating systems are not frozen in position by water which may be deposited from the warmer air of the surroundings when the doors are opened.

• A new 108-foot shrimp trawler, Arcturus, designed to freeze shrimp while on the fishing grounds, has been built by Higgins Co. of New Orleans for the Gulf Frozen Shrimp Co., Inc. The freezing equipment was made by Carrier. The Arcturus is equipped to catch, clean, pack and freeze shrimp, discharging neat frozen cartons all ready for the consumer.

• Minneapolis-Honeywell Regulator Co. has turned the tables and sold a number of its American-made clocks to the Swiss. Thomas McDonald, vice-president in charge of sales for the company, related the incident upon his return from a recent trip abroad. The sale involved a number of Chronotherms.

• Veterans and their families now constitute 32% of the nation's population. Five years hence they will constitute 43% of the U. S. total according to the Veterans' Administration.

Power Plant Expansion Requires Varied Pipe Welding

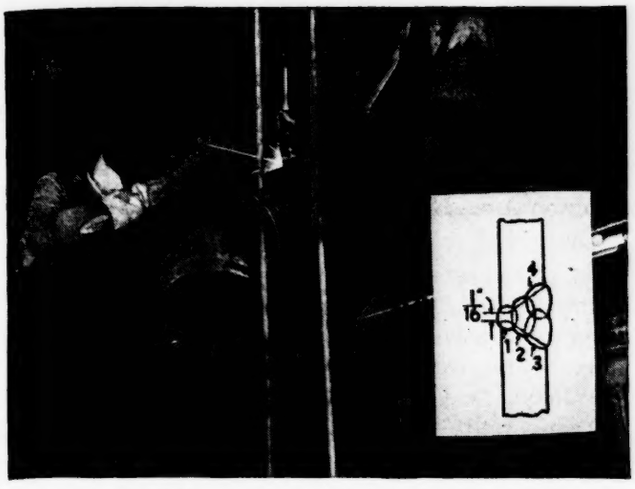


Fig. 1. Welding suspension cylinder to 8" steam line. Pipe joints were welded as shown in sketch.

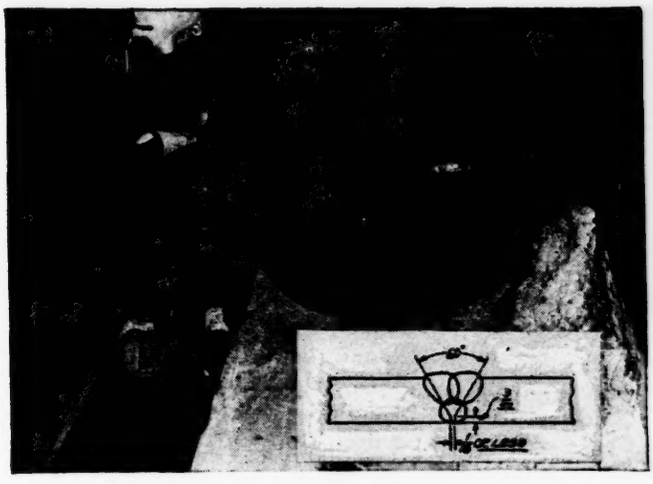


Fig. 2. Welds in these 6" and 4" horizontal pipes were made as shown in sketch.

By William P. Miller, Engineer
Smith & Oby Co., Heating Contractors
Cleveland, Ohio

THE municipal light plant at Painesville, Ohio, is being expanded by the addition of a new boiler and installation of tie-in lines between the various turbo-generators, pumps and boilers for greater flexibility of operation. Main steam lines will carry 600-lbs. pressure.

All pipe connections are being made by arc welding except where valves and equipment have bolted flanges. "Fleetweld 5" electrode is being used.

Fig. 3. Welds in extra-heavy 3" pipe were made in 3 passes.

Fig. 1 shows the welding of the bracket of a spring suspension cylinder to an 8" steam line. This cylinder permits the movement of the pipe caused by an expansion joint below. The elbows are "Tube Turns." These horizontal welds in 8" vertical pipe were made in four passes, as shown in sketch. Pipe ends were bevelled 30°. Stringer pass was made with 1/8" "Fleetweld 5" electrode and subsequent passes with 5/32" size.

Fig. 2 shows a 6" steam line reduced to 4" with a standard taper. Joints in both the 6" and 4" pipe were made according to the standard procedure for vertical welds in horizontal piping (see sketch), using 5/32" electrode for the stringer bead and 3/16" size for second and third passes. Elbows in both 4" and 6" pipe are "Tube Turns." The "fish-mouth" connection of the 6" lines was laid out by the template method and the pipe, flame-cut to the pattern.

Fig. 3 shows the welding of a 45° elbow to a 3" steam pipe. Since this is extra-heavy pipe, three passes instead of the usual two were made, and the sketch in Fig. 2 again applies. 1/8" electrode was used for all three passes.

Fig. 4 shows the bottom of an 8" vertical exhaust line from a warm water storage tank above, with three 4" lines branching off from it. The 1/2" plate on the end of the 8" pipe was welded on with 10 or 12 stringer beads. Joint was bevelled 60° to provide 100% penetration. The drain valve was screwed onto a short length of 2" pipe which was welded to the plate in 3 passes. The 4" pipes were welded to the 8" pipe in four passes, instead of three, for extra strength with 1/8" electrode on the stringer and 5/32" on the remainder. The "fish-mouth" ends of the 4" pipes were laid out to fit the contour of the 8" pipe by the template method.

Fig. 4. A 1/2" plate was welded on the bottom of this vertical 8" exhaust line.

The above is published by LINCOLN ELECTRIC in the interests of progress. Specifications and procedures for "Fleetweld 5" electrode are given in Bulletin 403. Write The Lincoln Electric Company, Department 483, Cleveland 1, Ohio.

Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

THE HEAT PUMP

A report of the indoor climate committee, residential section, commercial division, Edison Electric Institute, opens with a brief history of the heat pump and then discusses its operating principles in non-technical terms with simplified diagrams to show how the heat pump operates in both the heating and cooling cycles. The use of air, water, and earth as heat sources is described and illustrated and their relative advantages in different areas discussed. A survey of heat pump installations in the United States is classified according to heat source, with a large majority employing air.

The heat pump, with its promise of future increase in electricity consumption to a figure undreamed of even a few years ago, is being actively developed by the electric utility industry, according to the report. Although many problems remain to be solved before the heat pump can be used successfully in every part of the country, the report is optimistic about the future of this type of heating and cooling equipment.

The Heat Pump, What It Is—Its History—the Electric Company's Interest in its Development. Paper bound, 8½ x 11 in., 32 pages. Published by Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y. Price, 25 cents.

AIR CONDITIONING

A background of 35 years in the field of air conditioning and a mass of notes on the subject collected during these years, were drawn upon in the preparation of a book on air conditioning for the student and the engineer. Herbert Herkimer, consulting engineer, was assisted by his son, a design engineer, in the preparation of the text.

After covering the basic chemistry, physics and thermodynamics that are the foundation of air conditioning, data are presented on air and vapor mixtures, elements of health and comfort, cooling load, dehumidification and humidification with air washers, spray systems and cooling towers, drying, cooling methods and refrigeration, unit and central air conditioning systems, auditorium cooling, industrial applications, automatic controls and estimating costs.

Air Conditioning, by Herbert Herkimer and Harold Herkimer. Cloth bound, 5½ x 8½ in., 692 pages. Published by Chemical Publishing Co., Brooklyn 2, N. Y. Price, $12.

• • •

GRADING GAS HEATING EQUIPMENT — An interim bulletin of the House Heating and Air Conditioning Committee, Residential Gas Section of the American Gas Association, recommends an industry upgrading program for both equipment and installations. Gas companies are concerned with inferior heating equipment being sold and installed with little background experience. For a copy of the 15-page Interim Bulletin No. 77, write to American Gas Association, 420 Lexington Ave., New York 17, N. Y.

ASA STANDARDS—An entire new listing of the 874 standards available at the office of the American Standards Association has recently been issued. The standards are grouped in 15 main divisions in addition to an alphabetical listing of all the standards available. For a copy, write to the association at 70 East 45th St., New York 17, N. Y.

TRADE RECOMMENDATIONS FOR IRON VALVES—Simplified Practice Recommendation R184-47 covers a recorded voluntary recommendation of the trade regarding iron valves such as gate, globe, angle and check valves and is available as a 12-page booklet. It lists the standing committee in charge of the recommendations and a list of the manufacturers, distributors and others who have accepted the recommendations. Copies, 5 cents each, for sale by Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

STEAM JET EJECTOR STANDARDS—The second edition of Steam Jet Ejector and Vacuum Cooling Section Standards, a 40-page, paper bound book, is divided into three sections. Part 1 covers steam jet ejector standards; part 2, test code for steam jet ejectors; part 3, steam jet vacuum refrigeration equipment. Part 2 contains a number of important graphs on the thermodynamics of steam, and tables giving the capacities of air orifices at various barometric pressures. Part 3 covers standards for performance and construction of refrigeration equipment. Price, $1. Heat Exchange Institute, 90 West St., New York 6, N. Y.

CORROSION OF METALS BY FLUE GAS CONDENSATE—In a report to the American Gas Association, Battelle Memorial Institute has presented a Literature Review on Corrosion of Metals and Materials by Flue Gas Condensate, which has been issued as a paper bound report. The report summarizes the findings of a search into the subjects, and reports material abstracted from 55 articles that have been published during the past 25 years. A study of the material reveals many contradictory statements and therefore the report is intended only for general information and is not presented as design information that can be used directly. For a copy, write to Battelle Memorial Institute, Columbus 1, Ohio.

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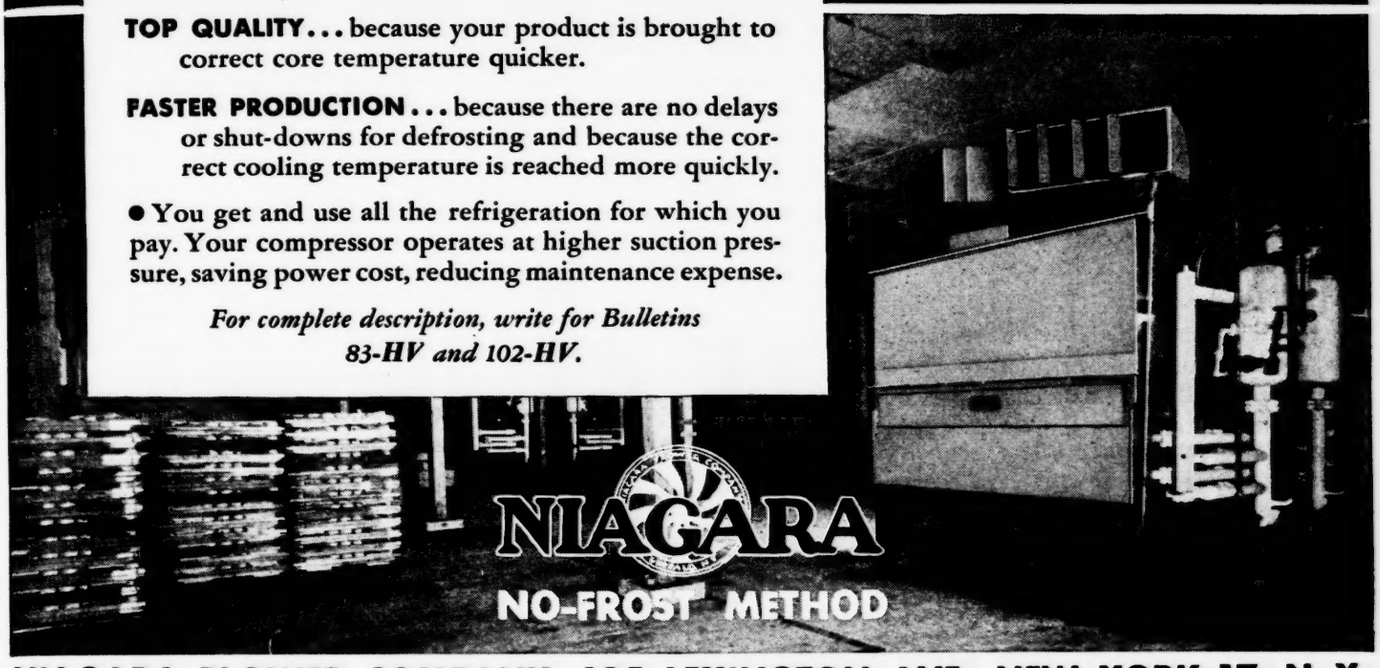
For complete description, write for Bulletins 83-HV and 102-HV.



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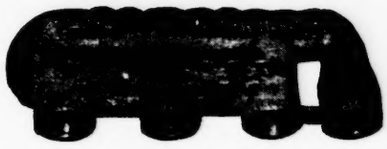

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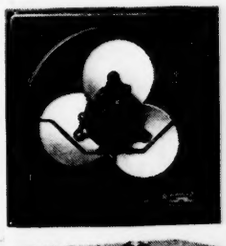

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NEW CATALOGS

ABC's of Wrought Iron

A 20-page illustrated booklet tells in non-technical terms what wrought iron is, why it resists corrosion and withstands shock and vibration, how it is made, and how it is bent, welded and threaded. The various services for which wrought iron pipe and plates are used in the industrial, railroad, sewage and waterworks, construction, refrigeration, marine, and plumbing and heating fields also are depicted.—*A. M. Byers Co., Pittsburgh, Pa.* 371

Oil Burners

Five new specification sheets give complete specifications and mechanical description of the Beckett Commodore Series OB, M, ME, L and LE burners. Each sheet is illustrated with a photograph of the burner described.—*R. W. Beckett Corp., Elyria, Ohio.* 372

Aluminum Alloy Temper Designations

A revised system of nomenclature for designing and specifying aluminum alloys is described in a 16-page booklet. Need for the new system is emphasized by the example of the most widely used wartime aircraft alloy, formerly designated 25-S. Formerly it was impossible to distinguish on the drawing boards the difference between properties of the flat plate and the heat treated part for which this alloy was specified. Other similar inadequacies of the old system resulted in a new system, effective January 1, 1948, outlined in the booklet. — *Aluminum Co. of America, Pittsburg 19, Pa.* 373

Variable Speed A. C. Drive

A new four-page bulletin, 611-C, describes an alternating-current motor having infinitely adjustable speed. The Louis Allis Co.'s Ajusto-Spede provides a variable speed output with a constant torque characteristic through an entirely new eddy current principle without the usual motor generator set or exciter. The Ajusto-Spede operates directly from a 2- or 3-phase ac line. The drive is especially suited for driving variable speed machines requiring constant torque input throughout the operating speed range. Continuous duty speed ranges as high as ten to one are possible in the smaller sizes; intermittent duty speed range is infinite in all sizes.—*Louis Allis Co., 427 E. Stewart St., Milwaukee 7, Wisconsin.* 374

Air Conditioning

An 8-page brochure describes the Kathabar system of humidity control for comfort in air conditioning. Presentation is non-technical, and various items of equipment, their operating principles and applications are covered.—*Kathabar Division, Surface Combustion Corp., Toledo, Ohio.* 375

Moduflow

A new consumer booklet describes the Moduflow system of home heating with background material on the theory of human comfort, building heat loss, and the Moduflow system of continuous balance. Drawings and diagrams of various systems and applications are included. — *Minneapolis-Honeywell Regulator Co., Minneapolis 8, Minn.* 376

Die-Less Duplicating

An entirely new edition of catalog No. 47-12 gives information on the Di-Acro system of die-less duplicating. This 40-page catalog contains illustrations and specifications covering all Di-Acro benders, brakes, shears and rod partners which can be employed individually or cooperatively for the precision production of a wide variety of parts. Many "on the job" photographs, shown throughout this catalog, illustrate the flexibility of these machines in both experimental and production work in products which vary from miniature electronic parts to heavy agricultural equipment. —*O'Neil-Irwin Mfg. Co., Lake City, Minn.* 377

Rubber Matting

A new eight-page catalog section on rubber mats and matting, goes into detail regarding function, construction, and specifications of each of the different types of product in this field which the company manufactures. These include platform and standard perforated mats, runner, multi-link and EzyKleen mattings, molded and perforated door mats, shower stall and bath, stove and drainboard and so on.—*The B. F. Goodrich Co., Akron, Ohio.* 378

Steel Stocks

A 72-page catalog carries a list of tool and high speed steel warehouse stocks which not only indicates types, shapes and sizes available, but also shows the warehouse location of each item in stock. Final pages of the booklet are devoted to Carmet (Sintered carbide) products available.—*Allegheny Ludlum Steel Corp., 2020 Oliver Building, Pittsburgh 22, Pa.* 379

Leather Belting Data

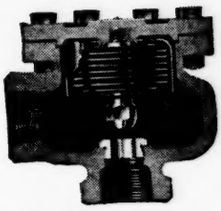
Engineering data for design and installation of leather belting systems for Rockwood short center pivoted motor base drives are contained in a 24-page booklet compiled by William Staniar, recently chief power transmission engineer for DuPont, and Samuel L. Allen, Rhoads design and sales engineer. — *J. E. Rhoads & Sons, 35 North 6th Street, Philadelphia 6, Pennsylvania.* 380

Wrenches

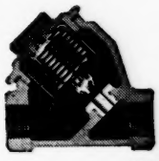
A 36-page catalog, No. 247, lists socket, box-type, and open end wrenches and sets, including new "Nugget" double duty drive socket wrenches.—*Blackhawk Mfg. Co., Milwaukee 1, Wis.* 381

DOES AIR SLOW UP YOUR STEAM LINES?

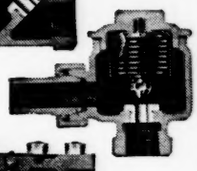
Nicholson 'Fast Action' Traps Discharge Air as Efficiently as Water



The positive, frequent intermittent action of Nicholson steam traps tends to pull air out of the system to the trap, where it is readily eliminated, speeding heat transfer. Installations result in production increases up to 30%.

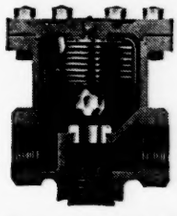


Bull. 544 or Sweets



5 Types for Every Application

Extreme simplicity makes unit trapping economical. 5 types for process, heat, power; size ¼" to 2"; pressures to 225 lbs. Bull. 544.



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Valves ★ Traps ★ Steam Specialties

HOW DURABLE IS IT?

That's the *important* point to investigate when buying underground pipe conduit.

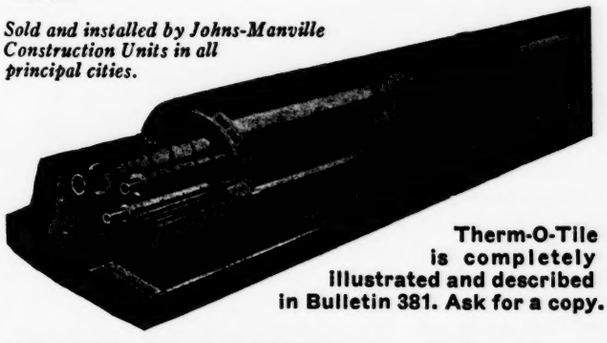
THERM-O-TILE

Reg. U. S. Pat. Off.

Therm-O-Tile is *permanent*. That's why it is so superior. It lasts much longer than a mere one, two, ten, or twenty years. Why? Because of its permanent tile envelope and its permanent concrete "Spread Footing Foundation." There is positively no sagging, rotting, or rusting.

In addition to being *permanent* Therm-O-Tile is competitive in first cost. You get *much more* per dollar.

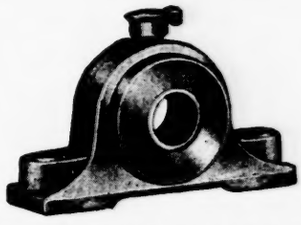
Sold and installed by Johns-Manville Construction Units in all principal cities.



Therm-O-Tile is completely illustrated and described in Bulletin 381. Ask for a copy.

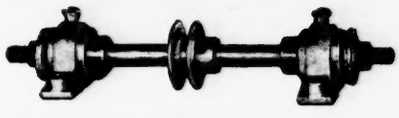
H. W. PORTER & CO., Inc.
823-V Frelinghuysen Ave. Newark 5, N. J.

Use CENTRAL PILLOW BLOCKS *and* MANDRELS



Precision machined to close limits for uniform, dependable performance and long life. Made of virgin zinc alloy—fitted with 2 OILITE ANTI-FRICTION BRONZE BEARINGS. Bore sizes ½"—⅝"—¾".

PRECISION BUILT • BRONZE BEARING

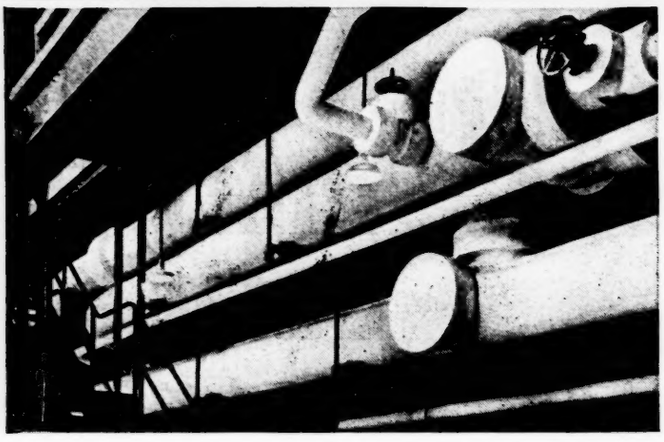


Shafts of smooth cold drawn steel, and die-cast collars of virgin zinc alloy. Both units precision machined to extreme accuracy. Mandrel furnished with 2 CENTRAL Pillow Blocks, with shafts threaded at one or both ends to take 2" O. D. v-groove.

PRECISION BUILT • BRONZE BEARING

CENTRAL
DIE CASTING AND MFG. CO.
2935 W. 47th ST., CHICAGO 32, ILL.

The easy, practical way to cover insulated surfaces



Sewing the canvas—or applying metal strapping—these time-consuming operations are no longer necessary. The canvas, asbestos, fiberglas or other non-conductor can be securely bonded with Arabol Lagging Adhesive.

This adhesive dries in 4 to 6 hours; *leaves a sized finish on the lagging material* . . . the job is completed. No paint need be used on this sized finish, unless you prefer to add one coat for appearance. Maintenance is simplified—grease, oil, soot and dirt wash off easily. And the adhesive is vermin-proof . . . fire-retardant, too.

Arabol Lagging Adhesive has successfully passed rigorous tests by independent laboratories. The results show that it retains its adhesive powers despite exposure to extreme temperatures, to immersion in water and to live steam.

Write us today for detailed facts and figures. Don't place open specifications on lagging work — ask for Arabol Lagging Adhesive. You can depend on it to fill your most exacting requirements for both utility and appearance. Also, ask about our cork cement for adhering cork to cork on refrigerator lines.

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CHICAGO—54th Ave. & 18th St. SAN FRANCISCO—30 Sterling St.

Branches in Principal Cities. Factories in Brooklyn, Cicero, San Francisco

Adhesives?... ARABOL!

Air Operated Controllers

A 40-page catalog, No. 8905, describes indicating, recording, and control instruments for temperature, pressure, flow, liquid level, and humidity. Photographs and drawings illustrate the construction and principles of operation of all instruments.—*The Brown Instrument Co., Wayne and Roberts Aves., Philadelphia 44, Pa.* 382

Pumps

Five separate bulletins describe each of the B-J lines of pumps classified as centrifugal, deepwell turbine, process, hydroplex, and single stage type SM process pumps. Each bulletin is illustrated with photographs and cross-sectional drawings, with applications and sizing data included.—*Byron Jackson Co., Los Angeles 54, Calif.* 383

Heaters and Thawers

Catalog No. 1047 describes and illustrates Hauk heaters and thawers for expediting outside work in winter. Said to provide a smokeless, 2000F flame, the line includes salamanders and flame, water, and superheated steam thawing equipment. — *Hauk Mfg. Co., 124-136 10th St., Brooklyn 15, N. Y.*.....384

Direct Contact Open Heaters

Three lines of open heaters for direct-contact heating of boiler feed and industrial process waters with available exhaust or live steam are described in Publication 4091. For capacities to 9,000 lb per hr, one-piece cast iron box heaters with sliding heating trays are available. For larger capacities up to 500,000 lb per hr, a number of constructions are available in cast and welded rolled plate construction. In capacities above 250,000 lb per hr a jet-type open heater can be supplied.—*Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia 32, Pa.* 385

OCTOBER, 1947

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Editor, HEATING AND VENTILATING,
148 Lafayette Street, New York 13, N. Y.

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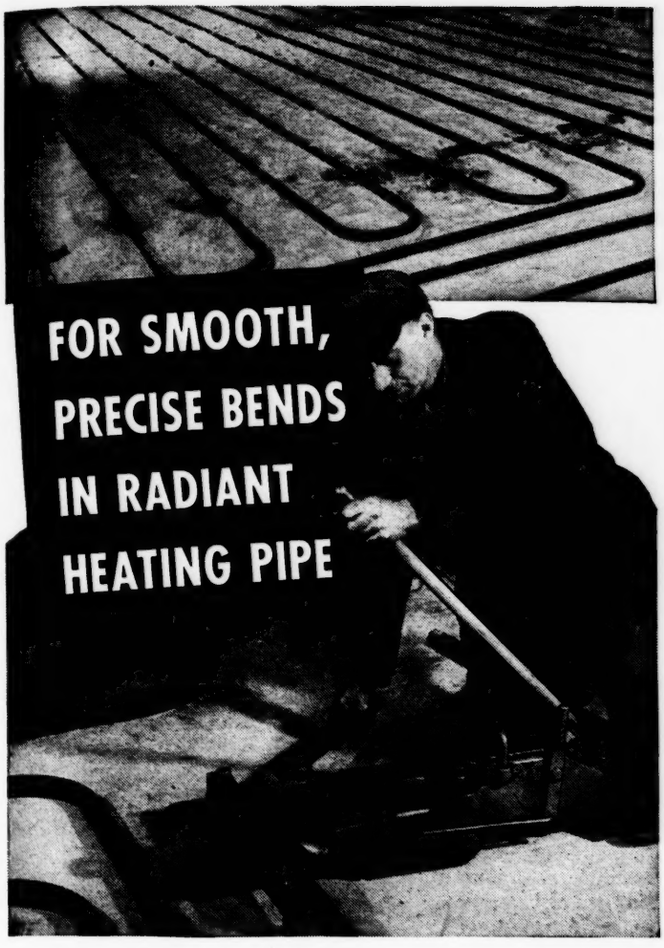

● Install radiant heating pipe the swift, sure way... with the GREENLEE 770-R Hydraulic Pipe Bender which makes precise 90° and return bends in *cold* pipe of sizes ½" through 2".

After making the above illustrated radiant installation with the aid of a GREENLEE, Bilz Plumbing and Heating Co., Spring Lake, Michigan, reported as follows. "One man operates the GREENLEE Bender easily *and fast*, thus providing a tremendous saving in labor hours."

"There's no flattening of pipe with a GREENLEE Bender, it brings substantial savings in fittings and manufactured bends. And, most important, there is *much less friction loss* in the system with curve bends instead of regular square fittings."

Do the job easier, faster, *better* with a GREENLEE. One-man-operated, compact, portable for on-the-job work. Two models for pipe from ½" to 4½". Write for details. Greenlee Tool Co., Division of Greenlee Bros. & Co., 2330 Twelfth Street, Rockford, Illinois.

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Self-Cleaning Feature of A-P DEPENDABLE Water Regulating Valve

. . . MEANS "TROUBLE-FREE" ACCURACY AND LONGER SERVICE

You'll avoid trouble—

due to dirt and lime in your water when you install the new A-P Model 68-B Water Regulating Valve on your water-cooled condensing units. A radically different construction principle actually "cleans itself," employing a molded composition seal on the valve stem which moves across the polished mirror-smooth stainless steel seat with an effective "wiping" action. Laboratory tested in sandy water, this unique sliding seal and seat showed no sign of water after the equivalent of many years use — proof of "lifetime" of accurate water regulating service.

With an operating head pressure of 50 to 150 p.s.i. Model 68-B can be easily adjusted to your system through the wide port in the body. Its long stroke provides closer, more uniform control without chattering or water-hammer. Three sizes, ⅜", ½" and ¾" inlet and outlet, offer a wide range of utility on Freon, Methyl Chloride or Sulphur Dioxide systems. Buy it today at your leading Refrigeration Jobbers — or write for bulletin No. M100.

DEPENDABLE Refrigeration Valves include: Thermostatic Expansion Valves, Refrigerant and Water Solenoids, Suction Pressure Regulating Valves, "Trap-Dri" Drier-Filter-Strainer and "Trap-It" Filter-Strainer, and Thermostats for cooling or heating.

AUTOMATIC PRODUCTS COMPANY
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FOR AIR CONDITIONING • REFRIGERATION • HEATING

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There's no reason to wait until next summer rolls around to make *these* dependable cooling appliances available. Many people are planning now to build or remodel their homes before next spring. They'll want to have the best in engineered cooling comfort—Bar-Brook attic and window fans. And remember, clubs and offices are year-round markets for dependable, economical ventilation equipment.

The installation of attic fans is an approved FHA home improvement. Homeowners may have as long as three years to pay, and in some cases the first payment may be deferred until spring.

Contact your nearest Bar-Brook distributor, or write to the Bar-Brook Manufacturing Company for details of Bar-Brook dealerships. It will mean cooling profits for you!

BAR-BROOK FANS

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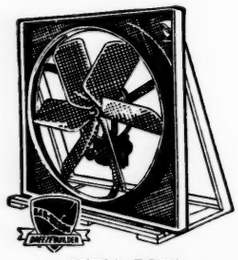

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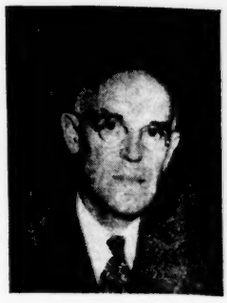
Getting Personal



D. L. Mills

Doremus L. Mills (Co-author, *Panel Heating with Copper Tubing—Experiment in Practice*, page 65) was born in Flatbush, L. I., now a part of New York City. After graduation from Pratt Institute of Science and Technology he entered the employ of the Safety Car Heating and Lighting Company. Several years with the American Radiator Company before its merger and with the Rome Brass Radiator Corporation preceded his connection with Revere Copper and Brass Incorporated where he is in charge of the Pipe and Tube Section of the Research Department in Rome, New York.

Aside from his business activities, Mr. Mills has developed a boyhood interest in pen lettering into a profitable avocation in the form of engrossing diplomas and certificates and illuminated resolutions and testimonials.

Mr. Mills is vice-president of the Central New York Chapter of ASHVE and a member of the American Society of Agricultural Engineers.

Leland J. LaTart (Co-author, *Panel Heating with Copper Tubing—Experiment in Practice*, page 65) was born in Olean, N. Y., and attended Syracuse Collegiate Center. He was employed by Revere Copper and Brass Incorporated immediately after his release from the Armed Forces. Serving as an artillery officer under General Patton, Mr. LaTart went through the entire North African campaign and was wounded in Sicily. Mr. LaTart is Mr. Mills' associate in the Research Department of Revere.

G. S. MacLeod

G. Stuart MacLeod (*Bonnet Output Nomograph*, page 94) was born in Chicago in 1911 and had his first taste of laboratory life in 1928 when he was made physics laboratory assistant in Shortridge (Indianapolis) High School. He attended the University of Cincinnati as a "co-op" in mechanical engineering from 1929 to 1931. After a series of miscellaneous selling jobs, he joined the Williamson Heater Co. where, after a thorough training in warm-air heating engineering, he served until 1942 as a field engineer in northeastern Ohio. He returned to the Cincinnati plant to help with war production, and since that time has done experimental work and testing of various types of heating units, primarily on solid-fuels magazine furnaces. He is a member of the Junior Board of Directors at Williamson, and his favorite pastime is promoting the ideals, ideas, and principles of "Multiple Management" of which system, he says Williamson Heater Co. has been an ardent champion for nearly ten years.

. . Since the Last Issue

Organization of a new subsidiary company in Switzerland has been announced by the **Minneapolis-Honeywell Regulator Co.** **Charles B. Meech** has been transferred to Zurich as manager of the subsidiary company.

William L. Gabbert has been appointed manager of the New York sales office of the **American Air Filter Co., Inc.**, Louisville, Ky. Mr. Gabbert, who was graduated from the

A NEW PUMP IN THE Low Price Field

. . . GREATER EFFICIENCY
. . . LOWER MAINTENANCE

MODEL No. H S

The Same SKIDMORE — skilled pump engineering . . . the same simplicity of design and operation, that has made SKIDMORE Pumps outstanding for over 25 years, is now offered to you in this new low price Model No. H S Condensate and Boiler Feed Pump.

AHEAD ON ALL COUNTS

Low cost, low upkeep — designed to give 100% efficiency. The new type H S pump is the result of experience and research of the war years. In contrast to the increased manufacturing cost, Model No. H S has been developed to meet present day demands for a low price pump. This unit is very dependable and will operate at a wide range of pressures, handling the condensation requirements very satisfactorily from steam heating systems and process equipment.

Complete specifications and engineering data will be sent on request, write for Bulletin No. 14-AH.

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SKIDMORE PUMPS

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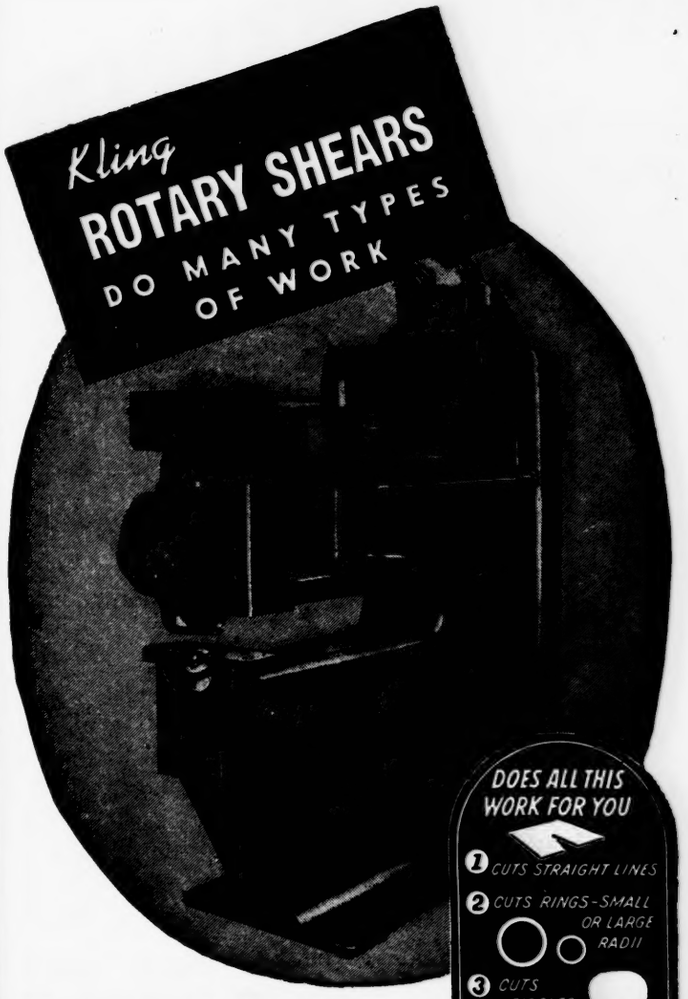

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1 CUTS STRAIGHT LINES
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3 CUTS CIRCLES
4 MAKES FLANGES
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6 JOGGLES & OFFSETS
7 CUTS ODD SHAPES
8 BEVELS OF ANY ANGLE
9 CUTS REVERSE CURVES
10 BEADS & CRIMPS
ALL WITH Hairline PRECISION

Yes, and With Hairline Precision

Rapid operation . . . Hairline Accuracy . . . the use of Kling Rotary Shears marks the latest development in cutting mild steel, and sheet metal, up to 1-inch with amazing savings in time, labor, and production costs.

For exacting projects (see illustration at the right), no single unit of metal-working equipment does so many different things so cleanly and efficiently as does the Kling Rotary, pictured above.

In metal-working plants, automotive, aviation, home appliance, and other industries, where work of this character is being done,—this machine is held in high regard for its versatility and economy of operation.

This great usefulness is the result of half-a-hundred years of engineering experience which prospective buyers, with reason and respect, applaud.

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which will give you specific facts, and specifications. No obligation involved. Users of heavy equipment of Kling Rotary Shears' class will receive a copy of this Bulletin promptly, on request.

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The puddle came from a leaky fitting. A cold check opened up from expansion and contraction.

It wasn't a "K" fitting. No, Sir! Because "K" fittings are precision-made in the first place, and then carefully examined for possible defects by eagle-eyed inspectors.

Play safe by looking for the "K" on the cast-iron fittings you buy and install.

• Standard and Extra Heavy Cast-Iron Fittings.
• Standard Flanged Fittings.
• Standard and Extra Heavy Companion Flanges.
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K

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COMPLETE LINE **K** CATALOG ON REQUEST

INSPECTED FITTINGS

COMBINED MARKET FACILITIES at Malleable Iron Fittings Co., Branford, Conn., and at Kuhns Bros. Co., Dayton, Ohio.

University of Kentucky in 1935 with an M.E. degree, has been with the company since 1935 serving in various capacities including that of district sales manager.

The New York Blower Co. announces the appointment of **Earl E. Trickler** as general sales manager to fill the vacancy caused by the death of Henry Mathis, vice-president, on July 18th. Mr. Trickler received his degree in mechanical engineering from Syracuse University in 1922 and is a member of the ASHVE. After a varied experience in engineering and sales work he joined The New York Blower Co. in 1934. Later he took a leave of absence to practice privately as a consulting engineer, returning to New York Blower after several years. Mr. Trickler, as well as having charge of sales, will continue as chief engineer to superintend all engineering developments.

E. E. Trickler

William E. Clark, general manager of **Dravo Corporation's Keystone Division** has been elected a vice-president of the corporation, at Pittsburgh. Mr. Clark was graduated from Ohio State University in 1921. Mr. Clark was appointed assistant to the vice-president of Dravo's Wilmington, Delaware shipyard in 1942, and in 1944 was appointed administrative manager. On June 1, 1945 Mr. Clark was transferred to Pittsburgh as General Manager of the Keystone Division. In 1946 he was elected a member of the board of directors of the corporation.

James G. Moravec has been appointed manager of the Moline, Illinois branch office for Penn Electric Switch Co. of Goshen, Indiana to succeed Howard C. Shilling, resigned. The Moline office of Penn Electric will remain in its present location at 535 Fifth Ave. Building.

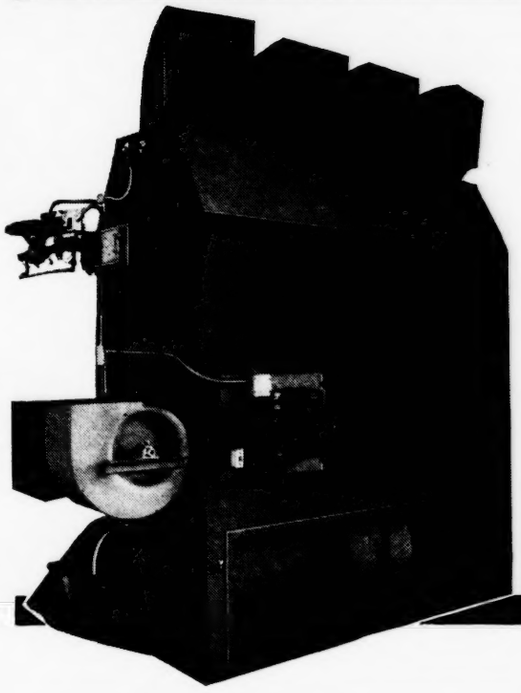
John H. Thomas will succeed **George E. Gregory** as vice-president and purchasing director of **Owens-Corning Fiberglas Corp.,** and **Ben S. Wright** will become Owens-Corning's general sales manager. These changes, effective October 1, were announced following word of Mr. Gregory's resignation from Owens-Corning to become president of the Morton-Gregory Company, Inc., a new organization being formed to manufacture and sell new industrial and consumer products calling for large scale use of Fiberglas yarns. Mr. Thomas has been Owens-Corning's vice-president in charge of sales since 1946. He has been with the firm since it was organized in 1938, and prior to that time was identified with Owens-Illinois research activities. Mr. Wright joined Owens-Corning in 1940 and was assigned to the general office sales organization as manager of the Fiberglas yarns division. In 1945 he became manager of the Fiberglas branch sales office in Cleveland. He returned to the firm's general offices in Toledo last month.

B. S. Wright

The New York branch of the **Frigidaire Sales Corp.** has announced the appointment of **F. Marion Drake** as general sales manager. Mr. Drake goes to his new post from Milwaukee where he has been manager of the district operation there under the Chicago branch.

AIRTHERM
DIRECT-FIRED WARM AIR HEATERS

Offer You These Six Heating Advantages

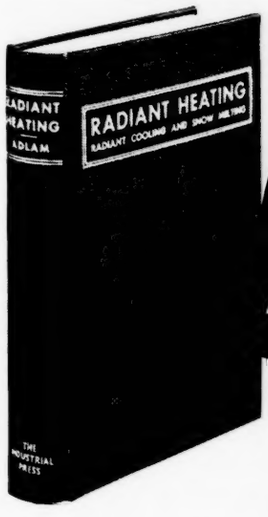


1. A complete factory heating unit.
2. Comes to you ready to set in place.
3. Control system wired at factory.
4. Available in floor-mounted or suspended models.
5. Oil burners or gas burners are interchangeable to meet future fuel conditions.
6. Capacities from 650,000 to 1,950,000 BTU per hour.

For detailed information, write for Bulletin 801-A.

AIRTHERM MANUFACTURING CO.

722 South Spring Ave. • St. Louis, Mo. 55



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Here are the basic principles, the experience-proved facts, the practical working data on applications of radiant energy for heating and cooling, and embedded pipe for snow removal. Everyone interested in this heating method will find the answers to his questions in this thorough treatise. Covering every phase of the subject, from first principles to actual step-by-step design and installation procedure, this volume is a dependable manual of ready-to-use information on a timely and important subject.

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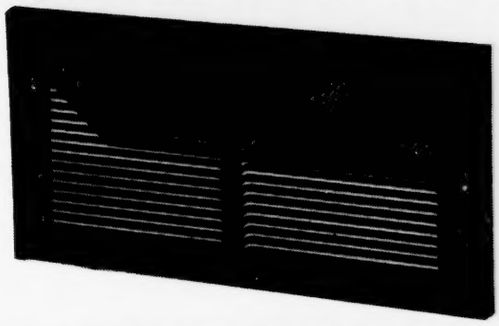


Series No. 200—AIR CONDITIONING LINE
HORIZONTAL, ADJUSTABLE
FIN-TYPE SINGLE SHUTTER VALVE

We also Manufacture a complete line of GRAVITY REGISTERS and GRILLES.

Series 200 registers were designed by engineers of long experience in the heating field, which accounts for their high efficiency and our ability to offer them at a very popular price.

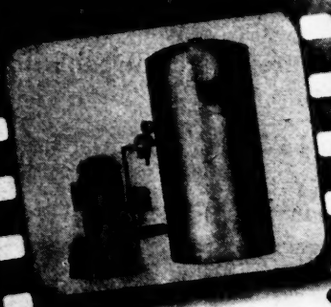
TURNBULL *MANUFACTURING AND DISTRIBUTING CO.*
9933 FREELAND AVENUE • DETROIT 27, MICH.

Double Feature

FOR A BIGGER SHARE OF DOMESTIC WATER SYSTEMS PROFIT!

Peerless Dealers

Can Meet the Needs of All Domestic Water Systems Installations with these Domestic Pumping Systems.



The Peerless Water King

For Shallow Wells

CAPACITIES: 275 TO 860 GALS. PER HOUR

This is the pump that gives "Magic Wings" to Water Lift! Simplified in design. Unique in operating principle. Offers an economical, automatic constant pressure water supply that rarely needs attention ... Easy to install, operate and understand.

The Peerless JET Pump

For Deep or Shallow Wells

CAPACITIES: 120 TO 7500 GALS. PER HOUR

A mighty producer of water from all well depths to 120 feet. For installation in wells 2" in diameter or larger. Peerless Jet Pumps are available in single or double pipe systems for installation over well or at any convenient location.

PEERLESS PUMPS

Plan WITH PEERLESS

For A Thriving, Profitable Dealership. Write us today for Full Details.

PEERLESS PUMP DIVISION

FOOD MACHINERY CORPORATION

Factories: Los Angeles 31, Calif.; Quincy, Ill.; Indianapolis, Ind.

District Offices: Chicago 40, 4554 North Broadway • Philadelphia Office: Suburban Square, Ardmore, Pa. • Atlanta Office: Rutland Building, Decatur, Georgia; Dallas 1, Texas; Los Angeles 31, California

Westinghouse Electric Corp. has announced the promotion of two key members of the company's education and training program. **Henry N. Muller, Jr.**, former manager of graduate student training, now becomes manager of the entire educational department. His former position will be taken by **Guy Kleis** who previously served as supervisor of engineering training.

Fred Gallup has been appointed sales manager of the **Aldrich Co.** Mr. Gallup's background includes sales executive positions with Chrysler Airtemp, Timken, and Bryant. He gained further experience while with both Johns-Manville and Celotex, working in the development of their insulation divisions.

Harold F. Dean, well-known heating engineer and former member of the Stoker Manufacturers' Association Engineering Committee has been appointed director of research for the **Conco Engineering Works.** Mr. Dean, a University of Illinois graduate, joined the Conco Engineering Works in 1924 and advanced through the positions of sheet metal works foreman, shop superintendent and chief engineer. During the war he served with the company as sub-contract executive coordinating all outside purchases of materials.

H. F. Dean

Welding Fittings Division of Tube Turns, Inc., Louisville, Ky., has announced the appointment of **Lewis M. Bound, Jr.**, as West Coast manager, with headquarters in San Francisco. A native of Independence, Kansas, he attended high school in Braintree, Mass,, Thayer Academy, and Purdue University. He joined Tube Turns' New York office sales staff in July 1941 and served three years in the Army.

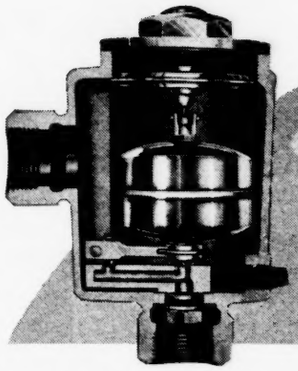
Richard M. Barnes has been appointed Northeastern sales and service manager for Dravo Counterflo heaters and crane cab coolers, it was announced by **Dravo Corp.**, Pittsburgh. Mr. Barnes' headquarters will be with Emerson-Swan, Inc., 712 Beacon St., Boston 15, Mass. and his territory will include New England and the northern part of New York State.

Mary K. Hays has joined **Harry Coleman & Co.**, Chicago public relations firm, as account executive for the South Wind Division of **Stewart-Warner Corp.** at Indianapolis.

The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio, announces the appointment of **Charles G. Herbruck** as assistant secretary of the foundation. Mr. Herbruck, a graduate of Princeton University, for the past five years has been employed in plant supervision in the welding industry.

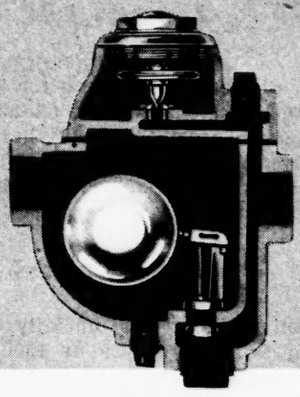
Two hundred and thirty-nine men from 14 states and Canada attended the first short course on hot water and steam heating systems sponsored by the **University of Illinois** and **The Institute of Boiler and Radiator Manufacturers** at Navy Pier, Chicago, September 9, 10, and 11.

The Formica Insulation Co., Cincinnati manufacturers of laminated materials, will have the assistance of **Morris Sanders**, New York architect, as a consultant on plastics, product development and design.

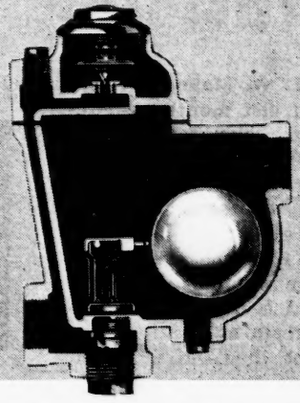


Marsh No. 17 Float and Thermostatic Trap for removal of air and condensate from short steam mains, branches and risers. Ideal for installation on unit ventilators and small unit heaters.

...Only the best traps are good enough



Marsh No. 12 Drip Trap — a float and thermostatic trap of larger capacity than the No. 17. Unit heaters, steam coils, etc. are within the capacity range of this trap.



Marsh No. 8 Drip Trap — a float and thermostatic trap larger than the No. 12 for quick removal of air and condensate from drip points on steam mains, coils, blast heaters and similar services. Still larger traps are available for heavy duty service.

Probably more otherwise good heating systems have been ruined by ineffective traps than can be charged against any other kind of equipment. Experienced heating men know this. They know that only the best trap is worthy of the vital job of keeping the system free of air and condensate, and to hundreds of heating men that means Marsh.

Three widely used, fully proved Marsh Float and Thermostatic Traps are illustrated here. They cover a wide range of applications for traps of this type in systems with working pressures up to 15 lbs. An outstanding feature of all of them is the Marsh Thermostatic diaphragm for venting air—a highly perfected unit which makes a particularly fine distinction between steam and heated air, so that air is properly removed without permitting steam to escape. The float operated valves in these traps are precision-built to give positive discharge and tight closure. Any one of the traps may be installed in the piping without other means of support.

Down to the last detail Marsh Traps have been perfected step by step across the years. They are *your kind* of traps: Well designed, well made, functional, practical. Years of practical experience have shown us how to apply these traps to best advantage in all types of systems. Ask for recommendations covering your particular needs.

MARSH HEATING EQUIPMENT COMPANY
2059 SOUTHPORT AVENUE • CHICAGO 14, ILLINOIS
Division of Jas. P. Marsh Corp.

MARSH *Quality Heating Specialties* SINCE 1865

Only FEDDERS
UNIT HEATERS
have all these features:
Streamlined copper tubes combine aerodynamic and heat transfer efficiency.
Deep flanges extruded into headers give abundant tube brazing area.
Individual copper fins have large-area bond to tubes.
Individual tubes "give" laterally to relieve expansion stresses between adjacent tubes.
Full floating element mountings relieve expansion stresses between core and cabinet.
Electrically welded cabinet provides rugged strength.
fedders.
FEDDERS-QUIGAN
CORPORATION
BUFFALO 7, NEW YORK

The Automatics Devices Co., Chicago, makers of The Weather-Man, "outside" type temperature control, announces the appointment of **Paul L. Olesen** as eastern manager. His address is: 5 Beekman Street, New York City 7, New York.

The Reading Tube Corp. of Reading, Pa. (offices in New York), makers of copper tubing, announces the appointment of **Joseph F. Murray** to the position of sales manager. Mr. Murray was formerly associated with the Jones and Laughlin Steel Corp. in the boiler tube and oil well supplies divisions and for the past five years was field supervisor for the tubular sales department.

J. F. Murray

Earle W. McMullen, director of research for **The Eagle-Picher Co.** and prominent in engineering chemistry, died August 26 at the Mt. Carmel Hospital in Pittsburg, Kansas. Mr. McMullen was 60 years old and was widely known for his chemical research. Pigments and vehicles had claimed Mr. McMullen's interest for many years.

A new administration building was officially opened by **Modine Manufacturing Co.** on July 29 at 1500 DeKoven Ave., Racine, Wis. In addition to office space, the new building adds about 35,000 sq ft of manufacturing space to the company's Racine facilities. The building is of one-story construction extending 185 ft across the front. Complete acoustical ceiling and fluorescent lighting complement a unique air conditioning system which extends throughout engineering, drafting, and office spaces.

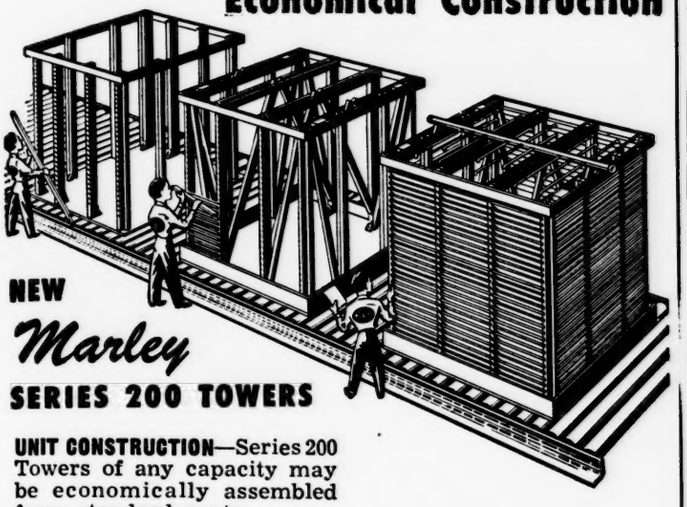
Election of **E. W. Meyers, Jr.** as president of **Trion, Inc.** was announced last month by Paul W. Aitkenhead, who resigned as president to become chairman of the board. Trion, Inc., a McKees Rocks, Pa. firm, was formerly known as the Pittsburgh Stove and Range Company. It was reorganized in February to manufacture Electric Air Filters which utilize the principle of electrostatic precipitation for removal of dust, dirt, pollen and smoke from the air of homes, commercial and industrial establishments.

E. W. Meyers, Jr.

Fitzgibbons Boiler Company, Inc. of New York has announced the appointment of **John R. Collette** as manager of field sales. Mr. Collette, from 1944 to April, 1947, was manager of the Firebox Boiler Division of the Titusville Iron Works Division of the Struther Wells Corp.

The American District Steam Co., manufacturers of steam distribution equipment, North Tonawanda, New York, announces the appointment of **Equipment, Inc.,** 35 Westminster Street, Providence, Rhode Island, as district representatives for the State of Rhode Island and Southeastern Massachusetts.

NOW THEY'RE *Standardized*
for Volume Production
Economical Construction



NEW
Marley
SERIES 200 TOWERS

UNIT CONSTRUCTION—Series 200 Towers of any capacity may be economically assembled from standard parts.

ADDED STRENGTH—Series 200 Towers are framed structurally complete before louver posts and louvers are added. Completely shop fabricated.

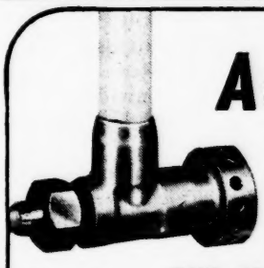
SPRACOIL COOLING—Series 200 Towers, without alteration, are adaptable for closed system cooling; utilize Marley Spracoils. Request Bulletin 2008-47

MARLEY PATENTED SPRAY NOZZLES are standard equipment in all Marley Atmospheric Towers.

MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

Automatic Liquid Feed
without Moving Parts



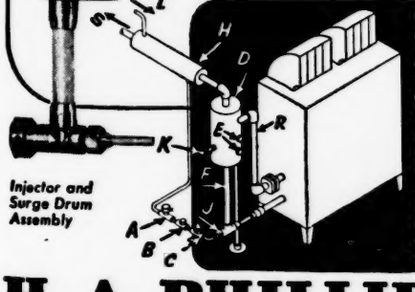
Injector with Distributor Head

THE PHILLIPS INJECTOR provides completely automatic evaporator feed with *no moving parts*. By supplying recirculated liquid steadily to the evaporator it increases heat transfer and increases the evaporator capacity.

Many existing dry-expansion evaporators can be easily changed to Injector operation, with improved performance assured.

Adaptable to "Freon" applications, from air conditioning and water chilling to cold storage installations with plate coils, fin coils, and unit coolers. Injector capacities from fractional to 200 tons with "Freon." Furnished with either single outlet or distributor head.

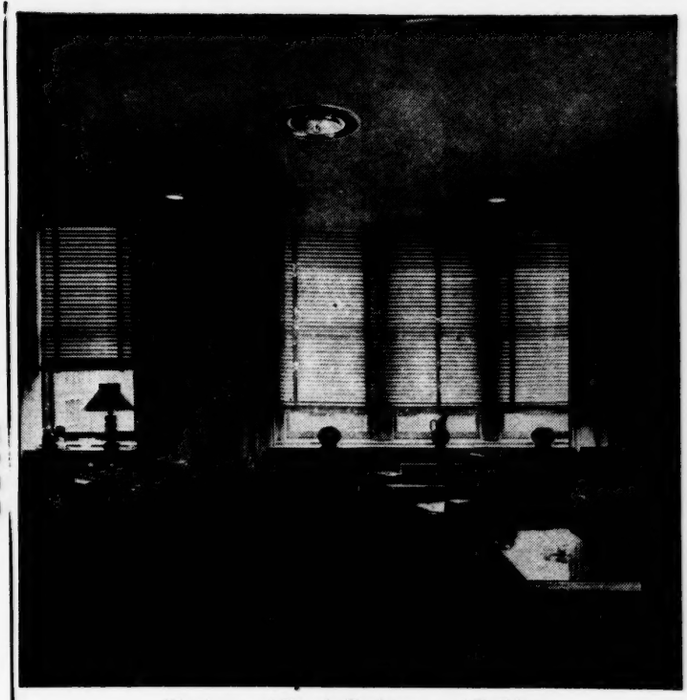
Write for sketches showing typical Injector installations.



Injector and Surge Drum Assembly

FLOOR TYPE ROOM COOLER HOOK-UP
A—MAGNETIC SOLENOID
B—BULLS-EYE
C—HAND VALVE
D—SURGE DRUM
E—SIGHT GLASSES
F—LIQUID LEG
H—HEAT EXCHANGER
J—INJECTOR
K—CHARGING CONNECTION
L—LIQUID LINE
R—GAS RETURN
S—SUCTION LINE

H. A. PHILLIPS & CO.
3255 WEST CARROLL AVENUE • CHICAGO 24, ILLINOIS



Sheehan and Krech, Designers and Builders
Air Conditioning by Schwerin Air Conditioning Corporation

Simply designed air diffuser blends with interior

Provides complete air conditioning comfort by eliminating drafts, noise, hot or cold spots.

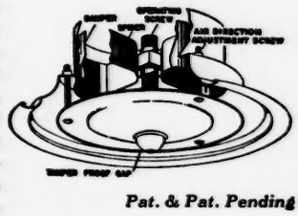
In addition to their unobtrusive appearance, Kno-Draft Adjustable Air Diffusers are specified for installations like the one pictured here in the offices of Schwarzenbach-Huber Co. because they combine all the advantages of scientific air diffusion plus adjustable features which assure positive air pattern control.

Kno-Draft adjustability increases efficiency and economy.

Diffusers improve occupant comfort by delivering conditioned air gently and thoroughly. Drafts and noise so often experienced with grilles, registers and other louvered devices are eliminated. Economy is increased. Diffusers handle greater air velocities and greater temperature differentials. This means less air volume, smaller, simpler ducts and fewer outlets.

To those advantages, Kno-Draft adds adjustment features that increase both the efficiency and economy of the air diffusion principle and a simplicity of design that blends with any interior.

Kno-Draft Direction Adjustment assures positive air pattern control by affording any angle of air discharge from vertical to horizontal that is needed to accommodate ceiling heights, individual or seasonal requirements. Volume adjustment is made with a patented damper that regulates the amount of air without affecting the velocity or diffusion pattern.

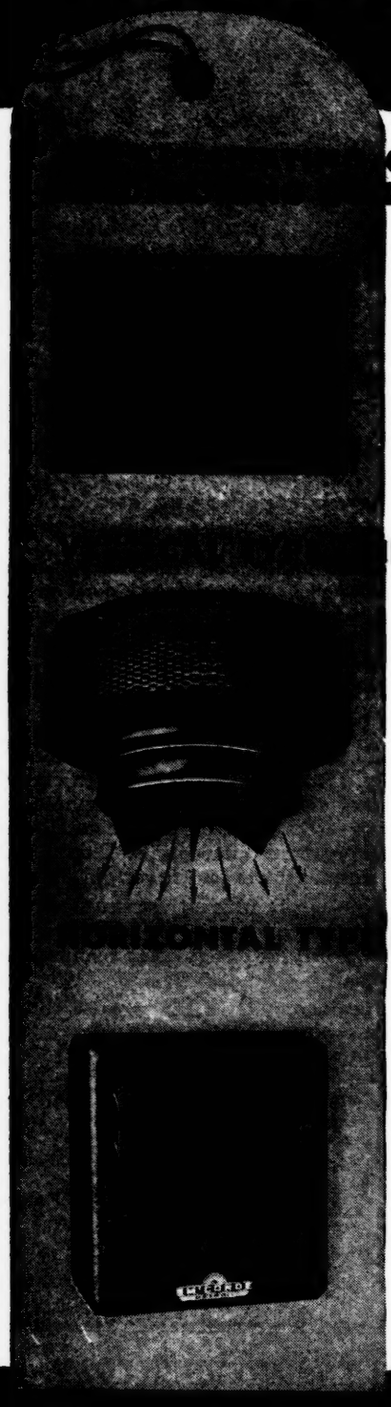


Pat. & Pat. Pending

Send for **FREE** handbook that simplifies the selection and installation of diffusers. Write Dept. E-16 on your letterhead.

W. B. CONNOR ENGINEERING CORP.
AIR DIFFUSION AIR PURIFICATION AIR RECOVERY
112 East 32nd Street — CONNOR — New York 16, New York
IN CANADA: Douglas Engineering Co., Ltd., 1405 Bishop St., Montreal 25, P.Q.

McCORD
HEATING AND AIR CONDITIONING PRODUCTS



COILS—AIR
LS—ALL TYPES

All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

IT HEATERS

A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.

UNIT HEATERS

A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

Save fuel with McCord Unit Heaters.

McCord CORPORATION
DETROIT 11, MICH.

A federal center of applied mathematics—the **National Applied Mathematics Laboratories**—has been established as a division of the **National Bureau of Standards.** The Applied Mathematics Laboratories include four separate laboratories: the Institute of Numerical Analysis; the Computation Laboratory (H&V:8:47:p118); the Statistical Engineering Laboratory; and the Machine Development Laboratories. **Dr. John H. Curtiss,** who has been the director's assistant in applied mathematics at the National Bureau of Standards, has been named chief of the National Applied Mathematics Laboratories at the Bureau. **Dr. Churchill Eisenhart** has been appointed head of the Statistical Engineering Laboratory. **Dr. E. W. Cannon** has been appointed chief of the Machine Development Laboratory. This laboratory is responsible for the development of high speed electronic computing machines now under construction by the Bureau of Standards. **Albert S. Cahn,** 36-year-old applied mathematician and meteorologist, has been appointed executive officer of the Institute of Numerical Analysis. The Institute has been located on the campus of the University of California at Los Angeles through a cooperative agreement between the University and the Bureau of Standards. **Dr. Arnold N. Lowan** has been appointed chief of the Computation Laboratory. Dr. Lowan's group, which is at present being underwritten by the Office of Naval Research, is providing a computation service and is continuing the work of the Mathematical Tables Project in the preparation of tables used in statistical and mathematical analysis.

The appointment of **H. C. Hickock** as general sales manager of the **Baker Ice Machine Co., Inc.,** has been announced. Mr. Hickock comes to Baker from the position of central district manager for the Sturtevant Division of the Westinghouse Electric Corp. A native of Massachusetts and a graduate of Worcester Polytechnical Institute, he served as a Naval officer in World War I, after which he joined Westinghouse. With Westinghouse, he engaged in a broad field of technical and sales activity which has fitted him uniquely for his new responsibility. **Sterling F. Smith,** Mr. Hickock's predecessor, has resigned to form his own organization to distribute Sterling transportation equipment and related specialties on a nationwide scale.

Scott-Newcomb, Inc. of St. Louis, Mo., have acquired 75 acres of land including buildings having over 100,000 sq ft of floor space. This property was owned by the Government and built in 1942 at a cost of $1,143,000 and will be served by a private railroad switch. New machinery is being added at a cost of approximately $80,000 to produce a complete line of heating and cooling equipment.

J. K. Rector, formerly assistant advertising manager of E. W. Bliss Co., has been appointed advertising and sales promotion manager of the **Watson-Stillman Co.,** Roselle, N. J., manufacturers of hydraulic machinery and mill distributors' products. A graduate of the Rice Institute, Mr. Rector later studied advertising at the Abbey Institute and at Wayne University. Prior to his entry into the field of advertising, Mr. Rector had a wide industrial experience, having held both technical and general administrative positions in the fields of petroleum, refining, shipbuilding, and machine tool production.

The **J. P. Ashcraft Co.** of 2826 Fondren Drive, Dallas, Texas, has been appointed sales representative in the North Texas territory for the **Research Products Corp.** of Madison, Wis. The Madison firm manufactures air filters, water treating minerals, and expanded fiber products.

The **Howell Electric Motors Co., Howell, Mich.,** have announced the appointment of **Charles T. Button** as general sales manager, effective September 15, 1947.

A. F. Boucher, welding engineer for **The Lincoln Electric Co.,** handling special accounts in the Detroit area, has been transferred to become district manager for the Milwaukee office at 733 N. Van Buren St., Milwaukee, Wis. **Marshall Ford** has been made district manager for Lincoln's Minneapolis office at 529 So. 7th St., Minneapolis, Minn. Mr. Ford has been a welding engineer for The Lincoln Electric Company since 1941 in the Pittsburgh district.

C. M. Rowland has been named sales manager of the newly created Commercial Refrigeration Distributor Division of the **General Electric Co.'s Air Conditioning Department.** Mr. Rowland, who will make his headquarters at Bloomfield, N. J., was formerly manager of sales for the department's Packaged Cooling Equipment Division which was discontinued concurrently with the establishment of the new organization.

Dr. Bernard Goerg, residential heating authority, has been appointed chief engineer of the **Lawson Mfg. Co.,** Pittsburgh, manufacturers of water and home heating equipment. Dr. Goerg begins his association with Lawson after more than 20 years with the American Radiator & Standard Sanitary Corp. From 1935 until this year, Dr. Goerg served as director of the Institute of Thermal Research of A.R. & S.S. The work of the institute is primarily the development of new heating equipment for residential purposes.

A new product service division, which will give 24-hour off-the-shelf service to its customers in all parts of the United States, has been announced by the **A. O. Smith Corp.** of Milwaukee, Wis. The new service facilities will begin to function immediately for the company's glass-lined water heaters, coal stokers, welding equipment, electric motors, pumps, and meters. The division's first unit is in operation now in Newark, New Jersey, at 115 Frelinghuysen Ave. Headquarters of the division are being established at 8312 South Chicago Ave., Chicago. A third unit will go into operation soon in Los Angeles. The manager of the division is **John J. Bohmrich.** He will have his offices in Chicago.

CONVENTION PROGRAMS

National Warm Air Heating and Air Conditioning Association.

A fuel forum is included in the program of the National Warm Air Heating and Air Conditioning Association that will be held at the Hotel Cleveland, Cleveland, Ohio, December 4 and 5. The new manual on Radiant Panel Warm Air Ceiling Systems will be made available at the time of the convention. The program follows:

Thursday, December 4

9:45 a.m.—President's opening talk . . . F. E. Mehrings

Research Progress. F. L. Meyer,
Chairman, Research Advisory Committee

Installation Codes. W. D. Redrup,
Chairman, Installation Codes Committee and Application Engineering Advisory Committee

Michigan State College Short Course
Professor Lorin G. Miller, Chairman,
Technical Education Committee

Extended Plenum Duct Systems, S. Konzo,
Professor of Mechanical Engineering, University of Illinois

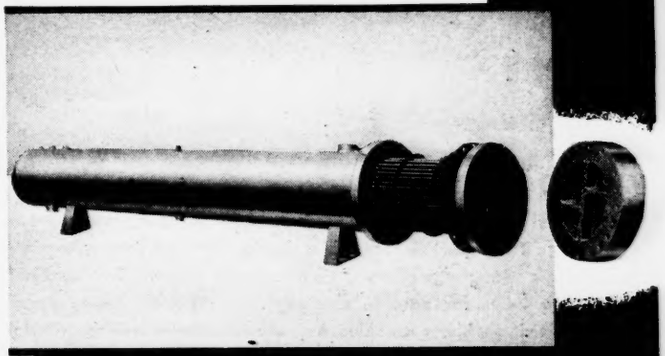
Measuring Performance of a Blower in a High-Boy Furnace
N. A. Buckley, Special Research Assistant, University of Illinois

2:15 p.m.—Election of officers and members Board of Directors

Panel Heating in the New Research Residence, R. W. Roose,
Special Research Assistant, University of Illinois

PATTERSON-KELLEY
Heat Exchangers
AND
Process Equipment

Heat-Transfer
SPECIALISTS



Specializing
IN REFRIGERANT
COOLERS

The very essence of "air conditioning" is the controlled transfer of heat.

It was entirely logical, therefore, that Patterson-Kelley engineers, who have specialized for years in heat-transfer equipment, should turn their attention years ago to refrigerant coolers, condensers and other heat-transfer equipment needed in air conditioning and refrigeration systems.

Today, Patterson-Kelley Equipment, coolers for example, is considered by many to be the standard for such installations.

EST 1880
THE PATTERSON-KELLEY Company, Inc.
2 WARREN STREET, EAST STROUDSBURG, PA.
NEW YORK 17—101 Park Ave. PHILADELPHIA 3—1700 Walnut St.
CHICAGO 4—Railway Exch. Bldg. BOSTON 16—96-A Huntington Ave.
Representatives in Principal Cities